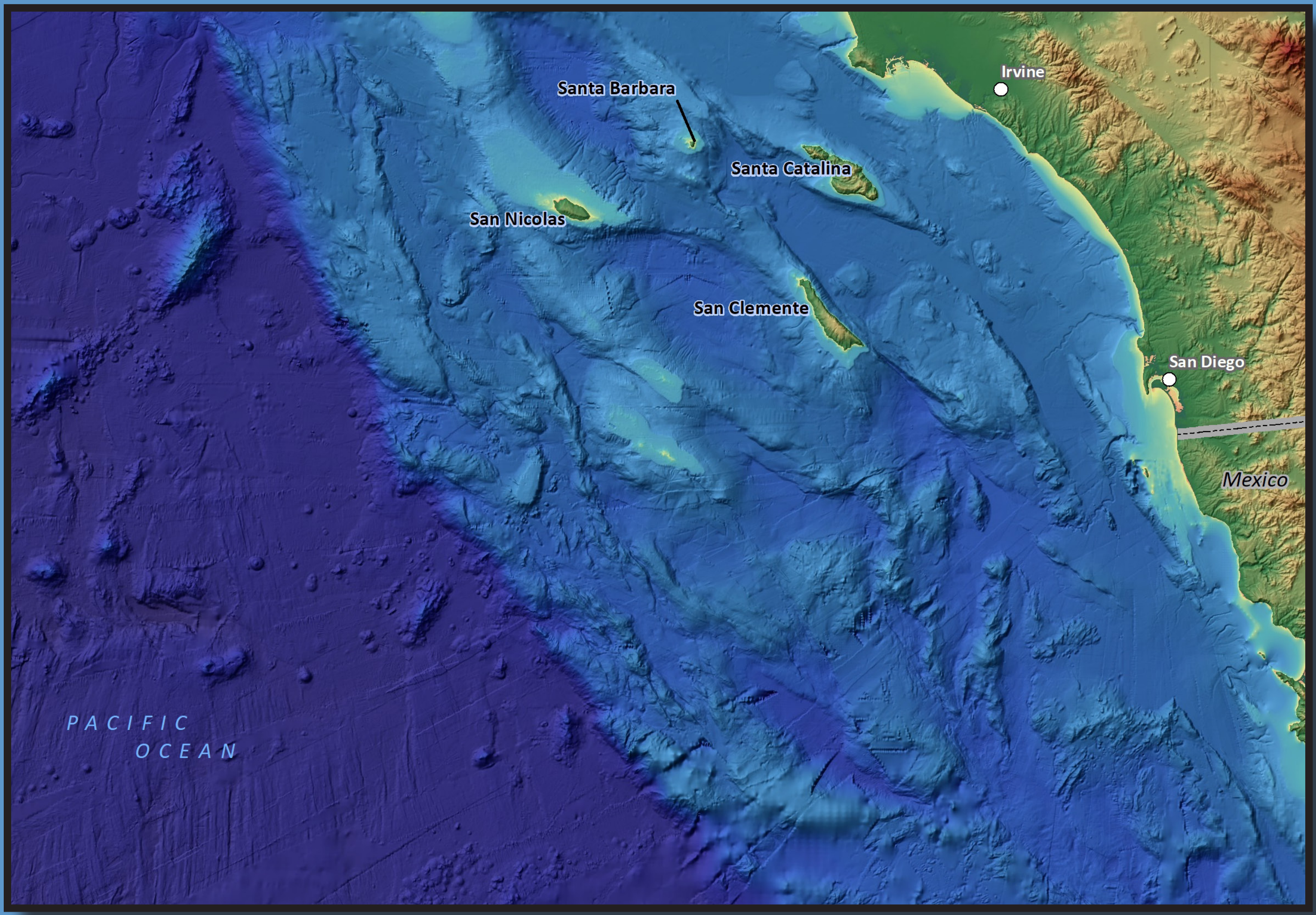
*Draft*

# Environmental Assessment/Overseas Environmental Assessment for the At-Sea Testing of the Ocean of Things Program San Diego, California

**February 2020**




DARPA

NAVWAR

Naval Information Warfare Center PACIFIC

DEPARTMENT OF THE NAVY UNITED STATES OF AMERICA

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# Abstract

**Designation:** Environmental Assessment/Overseas Environmental Assessment
**Title of Proposed Action:** At-Sea Testing of the Ocean of Things Program San Diego, California
**Project Location:** San Diego, California
**Lead Agency for the EA:** Department of the Navy
**Action Proponent:** Naval Information Warfare Systems Command, Naval Information Warfare Center Pacific
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**Date:** February 2020

The United States (U.S.) Department of the Navy (Navy) has prepared this Environmental Assessment (EA)/Overseas EA (OEA) in accordance with the National Environmental Policy Act and Executive Order 12114, as implemented by the Council on Environmental Quality and Navy regulations, for at-sea testing of the Ocean of Things program by Naval Information Warfare Systems Command (NAVWAR), Naval Information Warfare Center (NIWC) Pacific. The Ocean of Things program is an initiative of the Defense Advanced Research Projects Agency (DARPA) Strategic Technology Office, which focuses on technologies that increase military effectiveness through the use of networks, cost leveraging, and adaptability. The Proposed Action would consist of NIWC Pacific's implementation of Phase 1a of the Ocean of Things program, with the temporary deployment of up to 1,000 small (approximately 0.36 cubic foot per float), freely drifting floats for one month to measure environmental conditions and detect anthropogenic activity. The project location includes the Pacific Ocean off southern California and Baja California, beyond U.S. and Mexican territorial seas (12 nautical miles). The purpose of the Proposed Action is to develop a cost-effective program to characterize an oceanographic region by collecting and analyzing environmental and anthropogenic activity data at a scale and resolution that is currently not available. The Proposed Action is needed to fill a gap in maritime situational awareness by providing a regional, multivariate, high-resolution, real-time picture from a distributed sensor network on the ocean. Floats are designed to collect and transmit data such as ocean temperature, sea state, salinity, and location via Iridium Short Burst Data to a shore-side data cloud, which enables remote analysis of conditions and activities in the area. The floats are battery-powered by alkaline, lithium-ion, and/or lithium polymer batteries and some floats have small solar panels to recharge the batteries. Because of their small size and wide distribution, float recovery would not be practicable. Instead each float would be scuttled (i.e., sink to the ocean bottom) by the end of the test period. Because floats are non-recoverable, they were carefully designed to mitigate impacts to the environment (e.g., reduction of plastics). This EA/OEA evaluates the potential environmental impacts associated with either of two Proposed Action alternatives or a No Action Alternative to the following resource areas: marine biological resources, sediments and water quality, and public health and safety.

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# EXECUTIVE SUMMARY

**Proposed Action**

The United States (U.S.) Department of the Navy (Navy) has prepared this Environmental Assessment (EA)/Overseas EA (OEA) in accordance with the National Environmental Policy Act (NEPA) and Executive Order 12114, as implemented by the Council on Environmental Quality (CEQ) and Navy regulations, for Phase 1a at-sea testing of the Ocean of Things program. This program is being conducted by Naval Information Warfare Systems Command (NAVWAR), Naval Information Warfare Center (NIWC) Pacific on behalf of the Defense Advanced Research Projects Agency (DARPA). Ocean of Things is an initiative of the DARPA's Strategic Technology Office, which focuses on technologies that increase military effectiveness through the use of networks, cost leveraging, and adaptability. The Proposed Action would consist of NIWC Pacific's implementation of Phase 1a of the Ocean of Things program, with the temporary deployment of up to 1,000 small floats (approximately 0.36 cubic foot per float), which would collect and transmit environmental and maritime activity data while freely drifting for one month on the surface of the Pacific Ocean off of southern California and Baja California, overlapping the Navy's Southern California Range Complex, adjacent waters of the U.S. and Mexico Exclusive Economic Zones, and high seas of the global commons.

The Ocean of Things program is focused on innovative methods for filling a gap in maritime situational awareness and oceanographic research by obtaining and analyzing maritime and environmental data at an unprecedented scale and resolution. As a research and development program, its objective is to provide environmental sensing and maritime surveillance missions by developing new methods for detection and tracking of objects and characterization of oceanographic phenomena in a cost-effective way, taking advantage of developments in cloud-based analytic techniques to assess maritime conditions and contribute to oceanographic models in near real-time. The inputs for these data analytics over a large ocean area would be provided by deploying thousands of small, low-cost smart floats to form a distributed sensor network connected to a shore-side data cloud.

To effectively develop, demonstrate, and evaluate this evolving technology, the Ocean of Things program would consist of three distinct at-sea test phases:

- **Phase 1a: release of up to 1,000 floats for a 1-month period in a limited Study Area (this EA/OEA)**
- Phase 1b: release of up to 3,350 floats for a 3-month period in an expanded Study Area
- Phase 2: release of up to 15,000 floats for a 9-month period in an expanded Study Area

Each subsequent phase is defined by separate requirements and broadening objectives, which may involve alterations to design, programming, data processing, location, and/or number of floats released as the Ocean of Things program progresses. This approach results in distinct outcomes and decision points for each phase. Following the implementation of Phase 1a, in which three float designs would be tested, the Navy and DARPA would assess the demonstrated data analytics capabilities and performance of the floats. Any future proposal to implement Phase 1b would be conditional on the demonstrated success of Phase 1a. Similarly, any future proposal to implement Phase 2 would be conditional on the demonstrated success of Phases 1a and 1b. DARPA may re-evaluate and revise program objectives using lessons learned at the conclusion of Phase 1a. The suitability of the above phased approach in the waters off southern California may be re-evaluated at that time.

Phase 1a float deployment is being analyzed in this EA/OEA. Three float designs are proposed for Phase 1a. For purposes of analysis, it is assumed that each float design would represent approximately one-third of the 1000 floats to be deployed in Phase 1a. Each float design would progress through test phases independently; therefore, one-month deployments of each type of float may not be concurrent. Each float design would not be deployed under Phase 1a off southern California until the Navy independently tests and demonstrates the reliability of the geofence and scuttling capabilities (i.e., validation testing).

Contingent upon the results of Phase 1a, testing and deployments under both Phase 1b and Phase 2 would be analyzed in separate Supplemental EAs/OEAs to this EA/OEA. Distinct phase objectives, outcomes of prior phases, and any alterations to float designs would inform consultations with various agencies for each phase. The deployment of future phases is contingent on securing the necessary permits and authorizations.

The floats would be battery powered and drift freely until one of the following scuttling (i.e., commanded sinking) criteria is triggered: reaching a geofence (i.e., virtual set of geographic boundaries programmed into the floats, beyond which the floats would not be allowed to travel); battery power is low; communication or Global Positioning System (GPS) location is lost; end of the one-month test period; or on command via Iridium communication. Scuttling would be automatically initiated by float preprogramming (i.e., at geofence, under loss of GPS or communications, or low battery power conditions) or remotely directed from the Ocean of Things command center.

Floats have been designed to have a small footprint and would disperse over a large area; therefore, recovery of individual floats would not be practicable and is not proposed. Because floats would be non-recoverable, they were carefully designed to mitigate impacts to the environment (e.g., reduction of plastics). Each float contains a suite of commercially available sensors to collect data—such as ocean temperature, sea state, salinity, and location, which will enable analysis of conditions and activities in the area.

**Purpose of and Need for the Proposed Action**

The purpose of the Ocean of Things program is to advance the Navy's data collection in the area of meteorology, oceanography, and sensing by developing a cost-effective, low-environmental impact program to characterize an oceanographic region by collecting and analyzing environmental and anthropogenic activity data at a scale and resolution that is currently not available. The Proposed Action is needed to fill a gap in maritime situational awareness by providing a regional, multivariate, high-resolution, real-time picture from a distributed sensor network on the ocean. The primary user for Ocean of Things data would initially be the Navy, but data could also be used by other federal and state agencies and research institutions for purposes such as weather forecasting and calibrating ocean circulation models, monitoring vessel traffic, and in the management of marine protected areas.

Executive Order 13840, *Ocean Policy To Advance the Economic, Security, and Environmental Interests of the United States* (June 19, 2018) includes the goal to improve "…public access to marine data and information, efficient interagency coordination on ocean-related matters, and engagement with marine industries, the science and technology community, and other ocean stakeholders." The Ocean of Things program directly addresses this requirement by providing new, cutting edge ocean technologies and public access to the unique ocean information that will be collected by the Ocean of Things floats at higher spatial resolution than currently exists. Further, the Ocean of Things program directly addresses the requirement to "modernize the acquisition, distribution, and use of the best available ocean-related science and knowledge" by hosting and distributing this information to marine stakeholders (research institutions and government agencies) through modern cloud computing services.

The goal of Phase 1a is to use a limited number of floats (up to 1,000) in a bounded area to demonstrate: (1) float performance of three float designs over a defined duration and (2) use of cloud analytics to characterize a well-defined area. The Phase 1a Study Area would consist of predominantly deep, offshore waters, where potential impacts to coastal, shallow waters, and fisheries resources would be minimized, while still overlapping areas with sufficient opportunities to detect maritime activity. A key feature of the Phase 1a Study Area is the placement of mock islands, which are virtual islands created to demonstrate geofence performance around isolated land masses. Scuttle performance around mock islands would be used to support potential future deployments near actual islands. Phase 1a would provide information on float performance - their longevity, drift patterns, data collection and transmittal, and successful programmed scuttling at the boundaries of the geofence. Success in Phase 1a is a precondition to conducting Phases 1b and 2, which would characterize larger Study Areas using greater numbers of floats for longer periods of time.

**Alternatives Considered**

Among possible geographical locations on the East, Gulf, and West coasts and Hawaii, the Pacific Ocean off of southern California and Baja California was identified as the best location for the Navy to implement Phase 1a of the Ocean of Things program based on proximity to NIWC shore support facilities and the unique variability and richness of the natural environment, combined with the prevalence of civilian and military maritime activity. A variety of alternative technologies were considered as a means of meeting the project purpose and need, including drifters, gliders, and satellites; cabled, moored, boat- or shore-based sensor systems; and floats programmed to sample deeper layers of the ocean. The deployment of a large number of low-cost, surface floats was determined to be the most effective technology to meet the program's purpose and need. The possibility of allowing floats to drift indefinitely was rejected as unnecessary to meet the purpose and need of Phase 1a. As a result, it was determined that any viable action alternative should enable floats to be automatically scuttled upon reaching a pre-programmed Study Area boundary (geofence).

Two Proposed Action alternatives were identified: Alternative 1, under which floats would be released south of San Clemente Island and allowed to drift for one month or until they approach a geofence, where they would scuttle seaward of 12 nautical miles of any shoreline, at the boundaries of the Study Area, or at the mock islands; and Alternative 2, under which floats would be released farther off the continental shelf and allowed to drift for one month or until they approach a geofence where they would scuttle seaward of 12 nautical miles of any shoreline, at the boundaries of the Study Area, or at the mock islands. Under either action alternative, floats that have not yet scuttled at one of the geofence boundaries, nor under other preprogrammed scuttle conditions (i.e., extended loss of GPS or communications or low battery power), would be command scuttled at the end of the one-month test period. The only difference between the two action alternatives is that the eastern boundary of the Alternative 2 Study Area is located further offshore to be westward of the 3,500 meter bathymetric contour and avoids the continental shelf where most biological activity occurs.

**Summary of Environmental Resources Evaluated in the EA**

CEQ regulations, NEPA, and Navy instructions for implementing NEPA, specify that an EA/OEA should address those resource areas potentially subject to impacts. In addition, the level of analysis should be commensurate with the anticipated level of environmental impact. The following resource areas have been addressed in this EA/OEA: marine biological resources, sediments and water quality, and public health and safety. Because potential impacts were considered to be negligible or nonexistent, the following resources were not evaluated in this EA/OEA: cultural resources, visual resources, noise, transportation, hazardous materials and waste, socioeconomics, environmental justice, and air quality.

**Summary of Potential Environmental Consequences of the Action Alternatives**

Table ES-1 provides a tabular summary of the potential impacts to the resources associated with each of the alternative actions analyzed.

**Table ES-1 Summary of Potential Impacts to Resource Areas**

| *Resource Area* | *No Action Alternative* | *Alternative 1* | *Alternative 2* |
|---|---|---|---|
| Marine Biological Resources | No Significant Impact or Harm. There would be no change in existing conditions; therefore, no impacts would occur. | No Significant Impact or Harm. Localized, minor, temporary disturbances to small areas of marine habitat, with no overall effect on quality and/or quantity of essential fish habitat. Temporary behavioral avoidance of deployment vessel by fish, sea turtles, seabirds, and marine mammals. During deployment, on-board observers would be aware of and ensure avoidance of risks to sea turtles and marine mammals. Potential localized and temporary disturbance or harm to benthic invertebrates from scuttled floats. | Similar to Alternative 1 but at a lesser magnitude because the Alternative 2 Study Area essentially avoids the continental shelf where most marine systems are more biologically productive. |
| Sediment and Water Quality | No Significant Impact or Harm. There would be no change in existing conditions; therefore, no impacts would occur. | No Significant Impact or Harm. Gradual disintegration of floats would add trace amounts of metals and plastics to small areas of sediment and water, without measurable change in sediment and water quality. | Similar to Alternative 1 but at a lesser magnitude because the Alternative 2 Study Area essentially avoids the continental shelf where most biological activity occurs. |
| Public Health and Safety | No Significant Impact or Harm. There would be no change in existing conditions; therefore, no impacts would occur. | Precautions would be taken as needed to minimize hazards during deployment; Local Notice to Mariners would alert public to float deployment; floats would be labeled to identify any hazards and proper handling if encountered; deployment vessel would observe standard operating procedures to avoid risks to public. | Similar to Alternative 1 but at a lesser magnitude because the Alternative 2 Study Area essentially avoids the continental shelf where most small vessels and recreational activities occur. |

**Public Involvement**

Regulations from CEQ (40 CFR part 1506.6) direct agencies to involve the public in preparing and implementing their NEPA procedures. The Navy published a Notice of Availability for the Draft EA/OEA in the San Diego Union Tribune on February 14, 2020. The Notice of Availability describes the Proposed Action and Alternatives, solicits public comments on the Draft EA/OEA, provides dates of the 15-day public comment period (February 14 to March 2, 2020), and announces that the EA/OEA was available for review on CD at San Diego Central Library located at 330 Park Blvd, San Diego, CA 92101 and via the Navy Region Southwest website (https://www.cnic.navy.mil/navysouthwestprojects). Substantive comments received and responses to those comments will be provided in Appendix A (to be provided in the Final EA/OEA).

The Navy will coordinate or consult as appropriate or required, respectively, with NOAA's National Marine Fisheries Service (NMFS) and the U.S. Coast Guard.

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# Draft
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# At-Sea Testing of the Ocean Of Things Program
# San Diego, California
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# Appendices

# Abbreviations and Acronyms

| Acronym | Definition |
|---|---|
| CAA | Clean Air Act |
| CAAQS | California Ambient Air Quality Standards |
| CARB | California Air Resources Board |
| CEQ | Council on Environmental Quality |
| CFR | Code of Federal Regulations |
| CINMS | Channel Islands National Marine Sanctuary |
| CO | carbon monoxide |
| CWA | Clean Water Act |
| CZMA | Coastal Zone Management Act |
| DARPA | Defense Advanced Research Projects Agency |
| EA | Environmental Assessment |
| EEZ | Exclusive Economic Zones |
| EFH | essential fish habitat |
| EIS | Environmental Impact Statement |
| EO | Executive Order |
| ESA | Endangered Species Act |
| GHG | greenhouse gases |
| HAPC | Habitat Areas of Particular Concern |
| HSTT | Hawaii-Southern California Testing and Training |
| km | kilometer(s) |
| MBTA | Migratory Bird Treaty Act |
| MMPA | Marine Mammal Protection Act |
| MSA | Magnuson-Stevens Fishery Conservation and Management Act |
| MSS-TB | Maritime Surveillance System Test Bed |
| M/V | marine vessel |
| NAAQS | National Ambient Air Quality Standards |
| NALF | Naval Auxiliary Landing Field |
| NAVFAC SW | Naval Facilities Engineering Command Southwest |
| NAVWAR | Naval Information Warfare Systems Command |
| Navy | U.S. Department of the Navy |
| NBPL | Naval Base Point Loma |
| NEPA | National Environmental Policy Act |
| NIWC | Naval Information Warfare Center |
| NM | nautical mile |
| NMFS | National Marine Fisheries Service |
| $NO_2$ | nitrogen dioxide |
| NOAA | National Oceanic and Atmospheric Administration |
| $O_3$ | ozone |
| OEA | Overseas Environmental Assessment |
| OEIS | Overseas Environmental Impact Statement |
| PFMC | Pacific Fishery Management Council |
| PM | particulate matter |
| $SO_2$ | sulfur dioxide |
| SCB | Southern California Bight |
| SOCAL | Southern California |
| U.S. | United States |
| U.S.C. | U.S. Code |
| USEPA | U.S. Environmental Protection Agency |
| USFWS | U.S. Fish and Wildlife Service |
| VOC | volatile organic compounds |

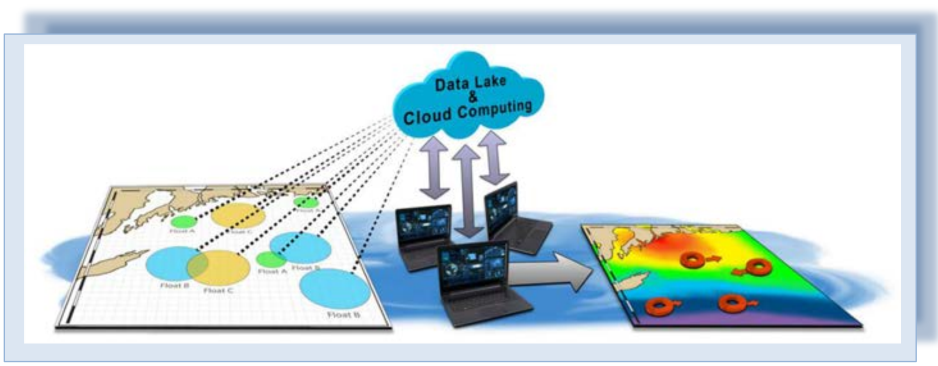
# 1 Purpose of and Need for the Proposed Action

## 1.1 Introduction

This Environmental Assessment (EA)/Overseas EA (OEA) has been prepared by the United States (U.S.) Department of the Navy (Navy) to address a proposal by the Naval Information Warfare Systems Command (NAVWAR), Naval Information Warfare Center (NIWC) Pacific to conduct Phase 1a at-sea testing of the Defense Advanced Research Projects Agency's (DARPA) Ocean of Things program. Phase 1a testing would occur in the Pacific Ocean offshore of southern California and Baja California, overlapping the Navy's Southern California Range Complex, adjacent waters of the U.S. and Mexico Exclusive Economic Zones (EEZs), and high seas of the global commons. The Navy has prepared this EA/OEA in accordance with the National Environmental Policy Act (NEPA), as implemented by the Council on Environmental Quality (CEQ) Regulations and Navy regulations for implementing NEPA and, for areas beyond the U.S. Territorial Sea (extending 12 nautical miles [NM] offshore), Executive Order (EO) 12114, *Environmental Effects Abroad of Major Federal Actions*.

## 1.2 Ocean of Things Program Overview

The Internet of Things connects an ever-growing number of smart devices for up-to-the-minute monitoring and tracking of many common events. However, in most parts of the open ocean, no such capability exists for real-time monitoring of maritime activity or conditions. The Ocean of Things program is a research and development effort that aims to provide the expanded information capabilities associated with the Internet of Things to the ocean in a cost-effective way, taking advantage of developments in cloud-based analytic techniques to assess maritime conditions and contribute to oceanographic models in near real-time. Ocean of Things is an initiative of the DARPA's Strategic Technology Office, which focuses on technologies that increase military effectiveness through the use of networks, cost leveraging, and adaptability. The objective of the program is to provide environmental sensing and maritime surveillance missions by developing new low-cost methods for detection and tracking of objects and characterization of oceanographic phenomena at a fine scale over broad areas. The inputs for these data analytics over a large ocean area would be provided by deploying thousands of small, low-cost smart floats to form a distributed sensor network.




The floats are designed to drift freely on the ocean surface with surface currents. Each smart float contains a suite of commercially available sensors to collect environmental data, such as ocean temperature, sea state, salinity, and location, which will enable analysis of conditions and activities in the area. The floats would transmit data periodically via Iridium satellite Short Burst Data to a shore-side data cloud for storage and near real-time analysis, resulting, for example, in surface current tracking, identification of vessel activity, and monitoring of changing meteorological conditions. At the end of the designated period of data collection, or if the floats lose vital capabilities such as communications, the floats would scuttle (i.e., sink to the ocean bottom). Additionally, the floats would scuttle before crossing a designated geofence (i.e., a virtual set of geographic boundaries programmed into the floats, defined using Global Positioning System [GPS] parameters, beyond which the floats would not be allowed to travel). This geofence would be located to prevent floats from potentially going ashore, entering sensitive marine areas, or interacting with shallow habitats. The geofence will also minimize interaction between the floats and members of the general public, thus minimizing any potential health and safety risks. The floats are designed to minimize their end-of life footprint by making use of innovative materials, minimizing use of plastics, and staying within a small overall volume.

To effectively develop, demonstrate, and evaluate this evolving technology, the Ocean of Things program would consist of three distinct at-sea test phases:

- **Phase 1a: release of up to 1,000 floats for a 1-month period in a limited Study Area (this EA/OEA)**
- Phase 1b: release of up to 3,350 floats for a 3-month period in an expanded Study Area
- Phase 2: release of up to 15,000 floats for a 9-month period in an expanded Study Area

Each subsequent phase is defined by separate requirements and broadening objectives, which may involve alterations to design, programming, data processing, location, and/or number of floats released as the Ocean of Things program progresses. This approach results in distinct outcomes and decision points for each phase. Following the implementation of Phase 1a, in which three float designs would be tested, the Navy and DARPA would assess the demonstrated data analytics capabilities and performance of the floats. Any future proposal to implement Phase 1b would be conditional on the demonstrated success of Phase 1a. Similarly, any future proposal to implement Phase 2 would be conditional on the demonstrated success of Phases 1a and 1b. DARPA may re-evaluate and revise program objectives using lessons learned at the conclusion of Phase 1a. The suitability of the above phased approach in the waters off southern California may be re-evaluated at that time.

Phase 1a float deployment is being analyzed in this EA/OEA. Three float designs are proposed for Phase 1a. For purposes of analysis, it is assumed that each float design would represent approximately one-third of the 1000 floats to be deployed in Phase 1a. Each float design would progress through test phases independently; therefore, one-month deployments of each type of float may or may not be concurrent. Each float design would not be deployed under Phase 1a off southern California until the Navy independently tests and demonstrates the reliability of the geofence and scuttling capabilities.

Contingent upon the results of Phase 1a, testing and deployments under both Phase 1b and Phase 2 would be analyzed in separate Supplemental EAs/OEAs to this EA/OEA. Distinct phase objectives, outcomes of prior phases, and any alterations to float designs would inform any future consultations with various agencies for each subsequent phase. The deployment of future phases is contingent on securing the necessary permits and authorizations.

This phased approach is necessitated by an interest in developing, testing, and evaluating original, cutting-edge technologies while fully complying with the requirements of NEPA. The phases are designed to establish and document float reliability in controlled and limited deployments that build upon lessons learned as a means of responsibly expanding the scope of each phase of the program. If Phase 1a fails to demonstrate reliable float performance, the Navy would not proceed to Phase 1b as described and would re-evaluate the approach to the Ocean of Things program.

## 1.3 Location

The project location is in the Pacific Ocean off southern California and Baja California, generally south of the Channel Islands and extending offshore in the Pacific Ocean (Figure 1-1). This area was chosen due to its diversity of environments and likelihood of obtaining quality data to test the Ocean of Things programmatic requirements and proximity to NIWC research, development, test, and evaluation (RDTE) facilities in San Diego and to other Navy support facilities (e.g., Navy-owned San Clemente Island). Further, the waters off southern California are relatively well monitored by other research programs, compared to other ocean locations, providing valuable ground-truth data. This area provides not only commercial, private, and military vessels for observation, but also contains an abundance of fishing and marine mammal activity. This activity combined with consistent weather patterns will enable obtaining a rich data set compared to other regions. These ideal conditions would aid the development of this technology.

## 1.4 Background

The complexity of the ocean environment and operations therein has previously encouraged the use of innovative systems to understand maritime dynamics and activity. Ocean-sensing systems now in operation off southern California are associated with those of the Southern California Coastal Ocean Observing System (www.sccoos.org/about/technologies/) and include the use of shore-based high frequency radar to measure the speed and direction of surface currents; coastal meteorological stations; automated shore stations with a variety of sensors attached to piers; moorings of fixed buoys that carry packaged sensors spaced throughout the water column; boat-based programs sampling physical, chemical, and biological properties; and gliders – autonomous underwater vehicles programmed to sample specific areas and depths of the ocean with automated sensors. Other ocean-sensing systems include: Argo (www.argo.ucsd.edu), a global network of widely dispersed, freely drifting floats programmed to descend and measure temperature, salinity, and currents in different layers of the ocean to better understand mechanisms behind global ocean phenomena such as El Niño; and the National Oceanic and Atmospheric Administration (NOAA) Global Drifter Program, comprising over 25,000 surface drifters worldwide, measuring ocean currents, sea surface temperatures, and barometric pressure (www.aoml.noaa.gov/phod/gdp/index.php). Each of these programs is limited in spatial resolution, geographic range, and type of data collected; therefore, they cannot provide the inputs necessary to conduct the data analytics that would enable high-resolution, near real-time characterization of the maritime environment for a specific region.

The Ocean of Things program is a unique approach, fielding a large number of low-cost floats at a relatively high spatial resolution and high rate of real-time data acquisition. Ocean of Things provides opportunities for affordable, integrated ocean sensing and a high-resolution understanding of the dynamics of ocean variables over fairly large scales in regions of interest. Improved maritime analysis provides a more detailed understanding of the natural and human elements of the ocean environment, allowing public agencies to better manage the resources and uses they are responsible for, and enabling the U.S. military to operate more effectively in U.S. territorial waters and on the high seas.

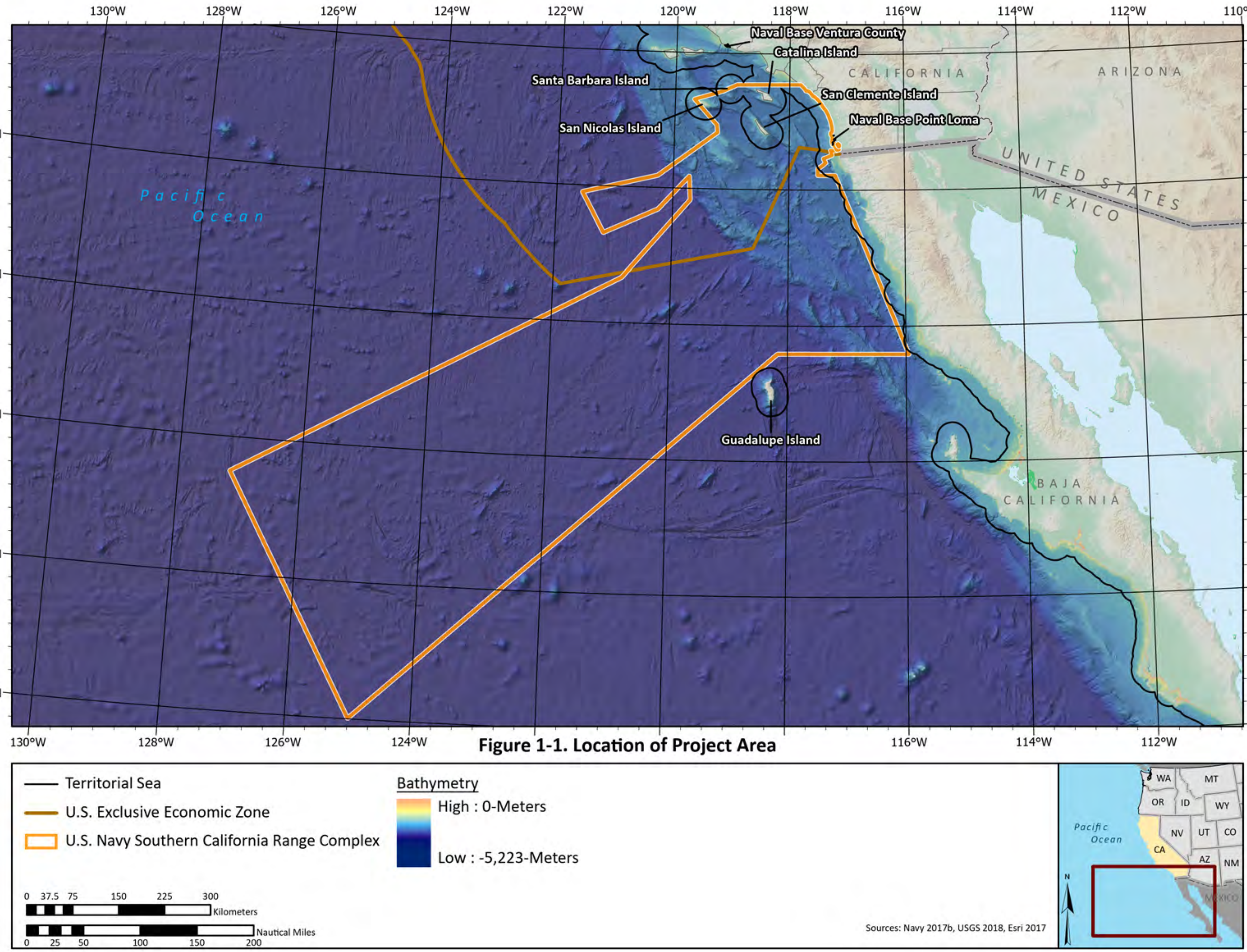



**Figure 1-1. Location of Project Area**

## 1.5 Purpose of and Need for the Proposed Action

The purpose of the Ocean of Things program is to advance the Navy's data collection in the area of meteorology, oceanography, and sensing by developing a cost-effective, low-environmental impact program to characterize an oceanographic region by collecting and analyzing environmental and anthropogenic activity data at a scale and resolution that is currently not available. The Proposed Action is needed to fill a gap in maritime situational awareness by providing a regional, multivariate, high-resolution, real-time picture from a distributed sensor network on the ocean. The primary user for Ocean of Things data would initially be the Navy, but data could also be used by other federal and state agencies and research institutions for purposes such as weather forecasting and calibrating ocean circulation models, monitoring vessel traffic, and in the management of marine protected areas.

EO 13840, *Ocean Policy To Advance the Economic, Security, and Environmental Interests of the United States* (June 19, 2018) includes the goal to improve "…public access to marine data and information, efficient interagency coordination on ocean-related matters, and engagement with marine industries, the science and technology community, and other ocean stakeholders." The Ocean of Things program directly addresses this requirement by providing new, cutting edge ocean technologies and public access to the unique ocean information that will be collected by the Ocean of Things floats at higher spatial resolution than currently exists. Further, the Ocean of Things program directly addresses the requirement to "modernize the acquisition, distribution, and use of the best available ocean-related science and knowledge" by hosting and distributing this information to marine stakeholders (research institutions and government agencies) through modern cloud computing services.

The goal of Phase 1a is to use a limited number of floats (up to 1,000) in a bounded area to demonstrate: (1) float performance of three float designs over a defined duration and (2) use of cloud analytics to characterize a well-defined area. The Phase 1a Study Area would consist of predominantly deep, offshore waters, where potential impacts to coastal, shallow water, and fisheries resources would be minimized, while still overlapping areas with sufficient opportunities to detect maritime activity. A key feature of the Phase 1a Study Area is the placement of mock islands, which are virtual islands created to demonstrate geofence performance around isolated land masses. Scuttle performance around mock islands would be used to support potential future deployments near actual islands. Phase 1a would provide information on float performance - their longevity, drift patterns, data collection and transmittal, and successful programmed scuttling at the boundaries of the geofence. Success in Phase 1a is a precondition to conducting Phases 1b and 2, which would characterize larger Study Areas using greater numbers of floats over longer periods of time.

## 1.6 Scope of Environmental Analysis

This EA/OEA includes an analysis of potential environmental impacts associated with two action alternatives and the No Action Alternative for Phase 1a of the Ocean of Things program. The environmental resource areas analyzed in detail for this EA/OEA include: marine biological resources, sediments and water quality, and public health and safety. Other resource areas are considered but dismissed from detailed analysis based on the low probability of any environmental impacts; these include: cultural resources, visual resources, noise, transportation, hazardous materials and waste, socioeconomics, environmental justice, and air quality. The Study Area for each resource is essentially the same, comprising the area where the floats would be initially deployed, and the ultimate area of their dispersal within the defined geofence.

## 1.7 Key Documents

Key documents are sources of information incorporated into this EA/OEA. Documents are considered to be key because of similar actions, analyses, or impacts that may apply to this Proposed Action. CEQ guidance encourages incorporating documents by reference. Documents that may be incorporated by reference in part include the Hawaii-Southern California Training and Testing (HSTT) Environmental Impact Statement (EIS)/Overseas EIS (OEIS). The Navy completed the Final HSTT EIS/OEIS and signed the Record of Decision in December 2018 (Navy 2018a) addressing the potential environmental impacts associated with the current, emerging, and future at-sea training and testing activities in the HSTT Study Area. The consultations (Magnuson-Stevens Fisher Conservation and Management Act [MSA] and Endangered Species Act [ESA]) associated with the HSTT EIS/OEIS are also being incorporated by reference.

## 1.8 Relevant Laws and Regulations

The Navy has prepared this EA/OEA based upon federal and state laws, statutes, regulations, and policies that are pertinent to the implementation of the Proposed Action, including the following:

- NEPA (42 U.S. Code [U.S.C.] sections 4321-4370h), which requires an environmental analysis for major federal actions that have the potential to significantly impact the quality of the human environment
- CEQ Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] parts 1500-1508)
- Navy regulations for implementing NEPA (32 CFR part 775), which provides Navy policy for implementing CEQ regulations and NEPA
- Clean Air Act (CAA) (42 U.S.C. sections 7401 et seq.)
- Clean Water Act (CWA) (33 U.S.C. sections 1251 et seq.)
- Coastal Zone Management Act (CZMA) (16 U.S.C. sections 1451 et seq.)
- National Historic Preservation Act (54 U.S.C. sections 300101 et seq.)
- ESA (16 U.S.C. sections 1531 et seq.)
- MSA (16 U.S.C. sections 1801 et seq.) (50 CFR sections 600 et seq.)
- Marine Mammal Protection Act (MMPA) (16 U.S.C. sections 1361 et seq.)
- Migratory Bird Treaty Act (MBTA) (16 U.S.C. sections 703-712)
- Bald and Golden Eagle Protection Act (16 U.S.C. sections 668 et seq.)
- National Marine Sanctuaries Act (16 U.S.C. section 1431)
- Marine Debris Research, Prevention, and Reduction Act of 2006 (“Marine Debris Act”) as amended, including the Save Our Seas Act of 2018 (33 U.S.C. sections 1951 et seq.)
- Marine Protection, Research, and Sanctuaries Act of 1972 (“Ocean Dumping Act”) (16 U.S.C. sections 1431-1447 and 33 U.S.C. sections 1401-1445 and 2801-2805)
- EO 11988, *Floodplain Management*
- EO 12088, *Federal Compliance with Pollution Control Standards*
- EO 12114, *Environmental Effects Abroad of Major Federal Actions* (the Navy analyzes environmental effects and actions beyond 12 NM [the territorial sea boundary] under the provisions of this EO)
- EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations* as amended by EO 12948
- EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*
- EO 13158, *Marine Protected Areas*

- EO 13175, *Consultation and Coordination with Indian Tribal Governments*
- EO 13186, *Responsibility of Federal Agencies to Protect Migratory Birds*
- EO 13840, *Ocean Policy to Advance the Economic, Security, and Environmental Interests of the United States*

A description of the Proposed Action's consistency with these laws, policies and regulations, as well as the names of regulatory agencies responsible for their implementation, is presented in Chapter 5 (Table 5-1).

## 1.9 Public and Agency Participation and Intergovernmental Coordination

Regulations from CEQ (40 CFR part 1506.6) direct agencies to involve the public in preparing and implementing their NEPA procedures. The Navy published a Notice of Availability for the Draft EA/OEA in the San Diego Union Tribune on February 14, 2020. The Notice of Availability describes the Proposed Action and Alternatives, solicits public comments on the Draft EA/OEA, provides dates of the 15-day public comment period (February 14 to March 2, 2020), and announces that the EA/OEA was available for review on CD at the San Diego Central Library located at 330 Park Blvd, San Diego, CA 92101 and via the Navy Region Southwest website (https://www.cnic.navy.mil/navysouthwestprojects). Substantive comments received and responses to those comments will be provided in Appendix A (to be provided in the Final EA/OEA).

The Navy will coordinate or consult as appropriate or required, respectively, with NOAA's National Marine Fisheries Service (NMFS) and the U.S. Coast Guard.

Should the Navy propose to conduct Phase 1b or Phase 2 of the Ocean of the Things program, supplemental EAs/OEAs for these separate phases may include additional coordination or consultation with the U.S. Fish and Wildlife Service (USFWS), National Park Service, California Department of Water Resources, Channel Islands National Marine Sanctuary, California Coastal Commission, and California Department of Fish and Wildlife.

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# 2 Proposed Action and Alternatives

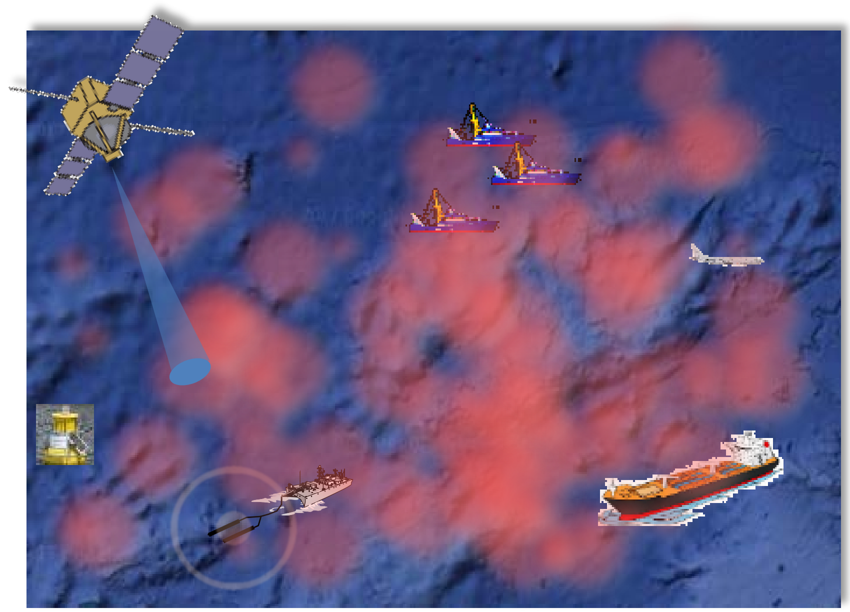
## 2.1 Proposed Action

The Ocean of Things program would provide environmental sensing and operational surveillance missions by distributing small, cost-effective floats with a combination of environmental and mission sensors, and subsequently analyzing that data in near real-time. The Ocean of Things program would be phased as described in Section 1.2, *Ocean of Things Program Overview*. This EA/OEA only considers implementation of Phase 1a. Phase 1a would consist of deployment of up to 1,000 small floats of three different designs (approximately 333 floats of each type). The floats would drift for up to one month over a limited Study Area in the Pacific Ocean off southern California and Baja California, beyond U.S. and Mexican territorial seas (12 NM), prior to scuttling near the boundaries of the geofence; under loss of GPS/communications or low battery power conditions; or at the end of the test period. Each of the three float designs would progress through test phases independently; therefore, one-month deployments of each type of float may or may not be concurrent.

### 2.1.1 Maritime Characterization through Cloud-based Data Analytics

The Ocean of Things program is focused on innovative methods for obtaining and analyzing high-resolution maritime and environmental data to enable characterization of the marine environment and tracking of maritime activity. A primary technical objective of the program would be to develop edge-processing methods (i.e., optimizing the floats' onboard computing system for real-time analysis and data discovery objectives) to identify and report the essential information from maritime events within a float's communication and energy constraints. The Ocean of Things program would also investigate the selection of sensors and sampling rates to maximize system performance.

Each float would characterize the physical environment through periodic sampling of local ocean properties, while also reporting nearby maritime events (e.g., vessel presence and activity). Examples of physical environment characterization include, but are not limited to, sea surface/air temperature, ambient noise, wind speed, wave dynamics, and float motion. Examples of activity characterization include the generation of vessel tracks, multi-spectral vessel signatures, vessel behavior, and hydrocarbon detection.



To enable timely characterization of activity and the regional environment, data would be collected from each of the floats via satellite network service and managed by NIWC Pacific. Floats would transmit data to the cloud (and receive commands) via the Iridium satellite constellation using Short Burst Data transmission. The Iridium system consists of 66 low earth orbit satellites licensed by the Federal Communications Commission to provide data transmission within an L-band frequency range of 1616 to

1626.5 megahertz. Iridium requirements prevent unacceptable interference to other users of those frequencies, and Iridium reviews and certifies applications for new users, such as Ocean of Things, on that basis.

Floats would report environmental data (e.g., ocean temperature, sea state, location) at programmed intervals. The transmitted data would contain sufficient information for application of advanced processing techniques (e.g., filtering, clustering, and machine learning). Analysts would utilize techniques to process these data to develop vessel tracks, characterize vessel behaviors, and identify new signatures and signal associations in the collected data. Finally, the Ocean of Things program would research methods to visualize coverage, predict performance, and optimize data collection from individual floats within a large field of floats.

### 2.1.2 Float Design and Materials

A primary goal of the Ocean of Things program is to minimize the footprint of each float. Because the floats would be too small and dispersed too widely to be recovered, each float would be scuttled (sink to the ocean bottom) by the end of the test period. Because floats would be non-recoverable, they were carefully designed to mitigate impacts to the environment by making use of innovative materials, minimizing the use of plastics, and staying within a small overall volume (approximately 0.36 cubic foot per float body). Based on DARPA review of the initial proposed designs, the use of plastics in the floats was reduced by approximately 90 percent, with only 0.1 to 0.3 pound of plastic used in each float.

The types of materials would vary by float type and design as discussed below. Materials and components were selected to ultimately achieve a float persistence of 12 months. Floats would contain standard environmental sensing instrumentation in addition to mission-specific instrumentation. Float components would remain unclassified and commercially available. The floats would have the flexibility to accommodate various float sensors and payloads with minimal redesign.

Batteries have metallic (steel, copper, and/or aluminum) jackets and are encased in polypropylene battery packs. Battery types include the following, with components as listed below.

- Alkaline: manganese dioxide (cathode), potassium hydroxide (electrolyte), and zinc dioxide (anode)
- Lithium-ion (rechargeable): lithium cobalt dioxide (cathode), organic solvents and lithium hexafluorophosphate (electrolyte), and graphite (anode)
- Lithium iron phosphate (rechargeable): lithium iron phosphate (cathode), organic solvent and lithium perchlorate (electrolyte), and graphite (anode)

The floats containing lithium batteries have been equipped with small solar panels to recharge the lithium batteries during the day and thereby reducing the overall number and size of lithium batteries needed for the floats to complete their mission.

Floats would have a suite of sensors and instrumentation, potentially including any of the following:

- Camera
- Hydrophone
- Temperature sensor
- Pressure sensor
- Humidity sensor
- Hydrocarbon sensor

- Barometric pressure
- Solar intensity
- 3-axis accelerometer
- Compass
- Microphone
- Radio frequency receiver
- Salinity sensor
- pH sensor
- Global positioning system receiver

The combination of sensors can vary within any float design. All floats would have associated circuit boards and an Iridium 9602/9603 Short Burst Data modem for 2-way communication.

The Ocean of Things program has selected three teams (Numurus, Areté, and PARC) to design and manufacture floats based on program specifications outlined by DARPA. The floats would be assembled by the selected teams at their facilities, then delivered to the Navy for deployment. No environmental analysis is necessary for the use of these facilities because they are routinely used for similar purposes (i.e., to hold and service oceanographic instruments).

Numurus, Areté, and PARC will each produce a third of the floats for Phase 1a. Of the up to 1,000 floats, there would be three sub-types for each of the three designs with different instrumentation housed in the same primary float structure. Thus, there will be a total of nine types of floats demonstrated, from three general float designs. The materials and designs for the specific Phase 1a floats are provided in Table 2-1.

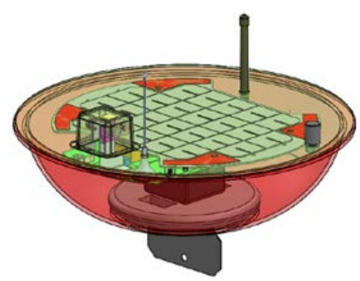
### 2.1.3 Deployment and Operation of Floats

In Phase 1a, the deployment of up to 1,000 floats in the waters south and southwest of San Clemente Island is designed to investigate float performance and maritime characterization capabilities over a one month period. The performance data obtained during Phase 1a would inform further system development and potential future expanded test phases.

Floats would be transported by the marine vessel (M/V) Diane G or a similar vessel from Naval Base Point Loma (NBPL) and released in a regular pattern within the deployment area, which is in the Navy's Southern California Range Complex and located predominantly south and southwest of San Clemente Island, but allows for the possibility of drifting freely within the geofence boundaries of the Study Area to the north and east (Figure 2-1). The vessel would then return to NBPL. Prior to deployment, a Local Notice to Mariners would be published describing the nature of the activity. The specific location where floats would be initially deployed within the Study Area would be informed by current patterns at that time and the experience of the Navy's oceanographers.

Because the Navy would not conduct Phase 1a for a float design until validation testing is complete for that specific design, Phase 1a testing of the three designs may be concurrent or may be conducted separately. Therefore, each float design type could be deployed separately for a total of up to three roundtrips from NBPL. The floats would be deployed approximately every two minutes from the slowly moving vessel, with an initial spacing of approximately 150-200 meters between floats.

### Table 2-1 Materials and Design Summary for Phase 1a Floats

| *Component* | *Numurus* | *Areté* | *PARC* |
|---|---|---|---|
| Outer Case | Biodegradable soy wax coated cardboard tube and endcap with aluminum base | Aluminum (1.61 pounds) with wood solar panel arms | Glass and stainless steel (0.8 pound) |
| Battery | Alkaline | Rechargeable lithium iron phosphate (1.47 pounds) | Rechargeable lithium-ion cells (1 pound) and alkaline 9-volt cells (0.21 pound) |
| Solar panel | None | Crystalline silicon on FR4 substrate with encapsulant (ethelyne vinyl acetate) and protecting layer (ethylene tetrafluoroethylene) | Crystalline silicon on FR4 substrate with encapsulant (ethelyne vinyl acetate) and protecting layer (ethylene tetrafluoroethylene) |
| Electronics | Small quantities (less than 0.5 pounds) of metals (iron, copper, silver, gold) | Small quantities (less than 0.5 pounds) of metals (iron, copper, silver, gold) | Small quantities (less than 0.5 pounds) of metals (iron, copper, silver, gold) |
| Suspended Attachments | Cotton drag cord, 6.7 feet long, with 60-pound breaking strength and 1.25-pound steel weight | None | None |
| Modem | Iridium modem | Iridium modem | Iridium modem |
| Other | Miscellaneous small plastic components (0.3 pound), steel | Miscellaneous small plastic components (0.1 pound), cardboard | Camera module in injection molded plastic; miscellaneous small plastic components (0.1 pound); keel and camera stand made of aluminum; iron weight |
| Size | 5-inch diameter tube by 18 inches long | 5-inch diameter tube by 18 inches long (in folded state) | Half dome shape that is 16.5 inches in diameter and 4.85 inches deep |
| Weight | 13.5 pounds | 7.2 pounds | 17 pounds |
| Scuttle Method | Case fills with water | Case fills with water | A small glass window on the bottom and top of the case breaks; case fills with water |
| Packing Material | Cardboard that would be recycled | Cardboard that would be recycled | Cardboard that would be recycled |
| Design |  |  |  |

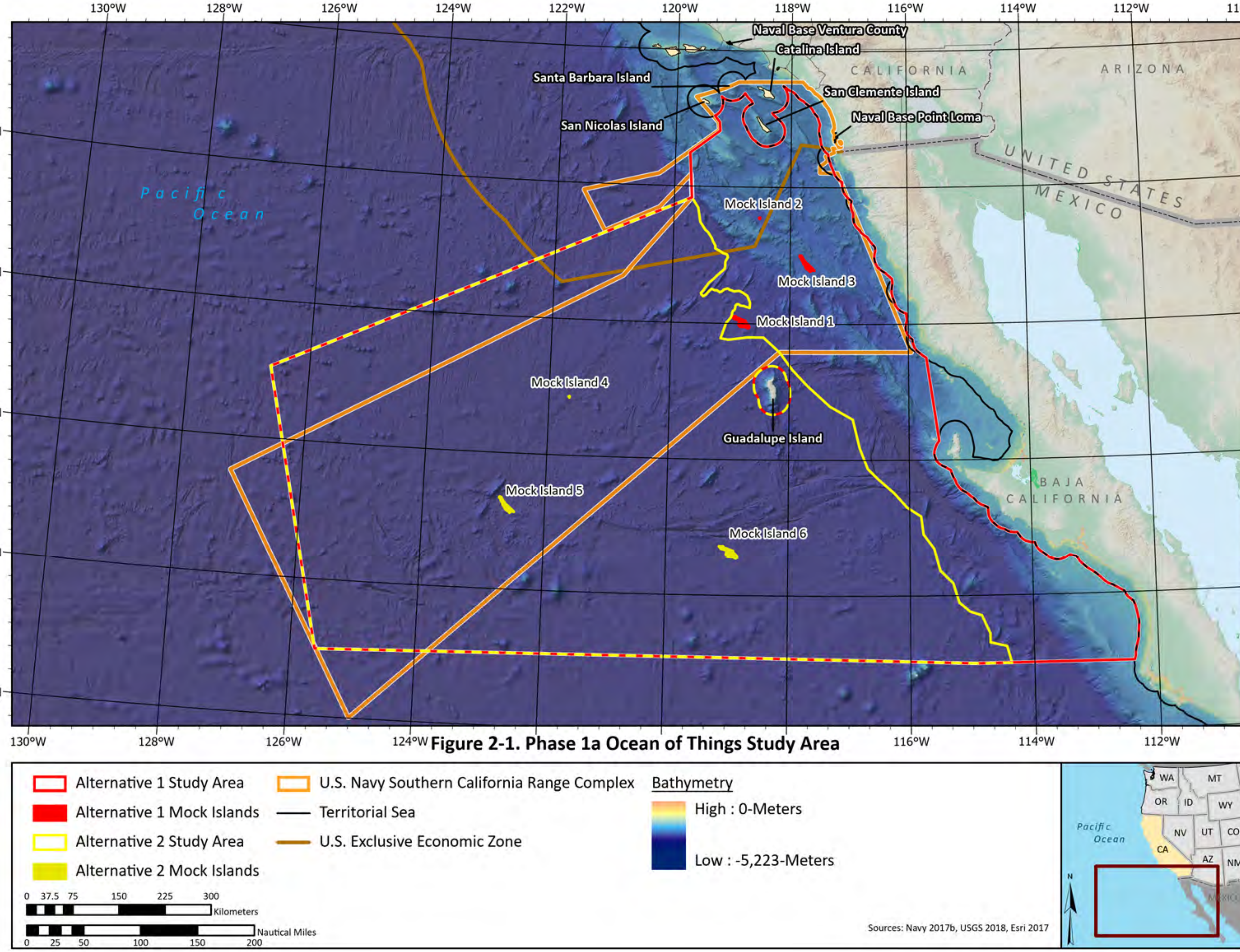



**Figure 2-1. Phase 1a Ocean of Things Study Area**

Floats are expected to spread out over time, although they could also move closer together depending on currents (D'Asaro et al., 2018). Although the float spacing would vary over time, the spacing is expected to allow for observation of oceanic submesoscale structures (on the order of 1-10 kilometer [km] horizontal, lasting for hours to days). Submesoscale processes are the eddies and similar interactions between currents and other bodies of water that occur at dimensions of less than 100 km across. These often-chaotic energetic processes affect upper ocean dynamics, thermodynamics, and biogeochemistry. Submesoscale structures are increasingly recognized as important dynamical features, previously overlooked due to difficulties in observing them (these structures are generally too small for observation via satellite remote sensing or ship-based surveys) (McWilliams 2016).

A majority of the floats are expected to drift southward, moving with the California Current and potentially reaching the southern boundary of the Study Area within the one-month period (Figure 2-1). Floats could also drift eastward, and then northerly in the California Countercurrent. The Phase 1a Study Area overlaps the Navy's Southern California Range Complex and would provide fairly detailed resolution of surface drift patterns applicable to objects as well as marine biota within this area of interest. Floats would be allowed to drift freely until one of the following scuttling criteria is triggered: reaching a geofence; battery power is low; communication or GPS location is lost for 24 hours; end of the one-month test period; or on command via Iridium communication. The floats would be programmed to scuttle at the boundaries of the Study Area, at the mock islands, or seaward of 12 NM of Guadalupe Island (Figure 2-1). Mock islands are virtual islands created to demonstrate geofence performance around isolated land masses. Scuttle performance around mock islands would be used to support potential future deployments near actual islands. An additional scuttle criteria is based on isolation in circumstances that continued data gathering from an isolated float would not serve the purpose of the program.

The Navy independently tested and demonstrated the reliability of the geofence and scuttling capability of the float types to be deployed in this Proposed Action. These tests consisted of lab testing; controlled, tethered testing; and monitored drift testing near San Clemente Island. The in-water tests of a small number of floats were conducted under the HSTT EIS/OEIS (Navy 2018a).

In the unlikely event that a float fails to scuttle as designed and washes ashore, an effort would be made to recover the float. Floats would be labeled to identify that they are part of a DARPA ocean research project and bar coded with points of contact to facilitate returning the float to DARPA. Labels would also provide a brief description of the float and the sensors on-board and identify any potential hazards (potential hazards are discussed in Section 3.6, *Public Health and Safety*). Should the float be picked-up while at-sea, the label would provide instructions for returning the float to the ocean.

### 2.1.4 Data Sharing

Environmental data would be available via a public facing website, subject to security requirements, to other federal, state, and local government agencies; academic and other scientific researchers; and commercial organizations. A goal of the collected data is to improve the accuracy and resolution of ocean current modeling through the Ocean of Things program's real-time, fine resolution data and characterization of the marine environment that cannot be achieved through existing technologies. The Ocean of Things program would provide improved accuracy that can potentially improve weather predictions, traffic patterns, traffic efficiency, and marine life protections. The availability of these data also enables analysis by multiple organizations to improve information or processes important to those organizations unrelated to the Ocean of Things program.

## 2.2 Alternative Development Criteria

NEPA's implementing regulations provide guidance on the consideration of alternatives to a federally Proposed Action and require rigorous exploration and objective evaluation of reasonable alternatives. Only those alternatives determined to be reasonable and to meet the purpose and need require detailed analysis. Potential alternatives that meet the purpose and need were evaluated against the following selection criteria:

- Location that provides a data-rich natural and human environment in proximity to naval facilities for logistics support
- Location with infrequent extreme conditions, such as hurricanes, enabling the persistence of a high percentage of floats to provide broad-scale, high resolution data for the duration of the test periods
- Ability to collect, transfer, and analyze real-time marine data
- Study design that provides relatively high resolution, fine-scale sampling of the marine environment over a broad area
- Study design that minimizes impacts to marine mammals, fishes, sea turtles, habitats, and water quality

## 2.3 Alternatives Carried Forward for Analysis

Based on the reasonable alternative selection criteria and meeting the purpose and need for the Proposed Action, two action alternatives in addition to the No Action Alternative were identified and will be analyzed within this EA/OEA.

### 2.3.1 Alternative 1

Under Alternative 1, up to 1,000 floats would be initially deployed in the Navy's Southern California Range Complex and allowed to drift for one month, or until they approach a geofence where they would scuttle seaward of 12 NM of any shoreline, at the boundaries of the Study Area, or at the mock islands (Figure 2-1). Automatic float scuttling would occur if any of these conditions are met or if floats lose critical capabilities (e.g., GPS or communications) for an extended period. Most of the Alternative 1 Study Area is outside of the U.S. EEZ, on the global commons of the high seas or overlapping the Mexico EEZ.

Under Alternative 1, floats would drift through areas with higher levels of maritime and military activity, providing increased opportunities to obtain data to meet the goals of the Ocean of Things program. In addition, the surface currents and environmental conditions would be more complex across the Southern California Bight (SCB), allowing for improvements in data analytics and regional characterization. The size of the area would allow for both fine scale and large scale characterization of oceanographic phenomena. Lastly, vessel transit time required to implement Phase 1a would be reduced compared to more remote (i.e., farther off shore) deployment areas.

Most floats are expected to drift southward until reaching the southern boundary of the Study Area and are not expected to reach the western boundary in the one-month timeframe (Figure 2-1). A southern geofence was defined to ensure that a large number of floats would be operational (i.e., not scuttled) for the full one-month test period. Although available surface drift modeling predicts widely varying extents of float travel using several years of historical surface data, in general, a large number of floats are predicted to remain north of the selected southern geofence boundary of 25 degrees North latitude.

A small fraction would be expected to approach the coast (either mainland or island) and would scuttle seaward of 12 NM of any shoreline or along the mock island boundaries.

Existing surface drift models and available contemporaneous oceanographic data have been used to inform Phase 1a deployment patterns to maximize data collection while minimizing loss of floats through scuttling. Drift patterns of floats in Phase 1a would further inform future deployments in Phase 1b and Phase 2.

### 2.3.2 Alternative 2

Alternative 2 would be the same as Alternative 1 except the Study Area would be located farther west of the continental shelf and only include the southwestern portion of the Alternative 1 Study Area (Figure 2-1). The eastern boundary was located to limit the Alternative 2 Study Area to being seaward of 3500 meter depth and outside of essential fish habitat (EFH) for groundfish. Under Alternative 2, floats would be initially deployed westward of the 3,500 meters bathymetric contour and different mock island locations would be used, as shown in Figure 2-1. Only a small fraction of Alternative 2 is within the U.S. EEZ; the rest is on the high seas of the global commons or a small portion of the Mexico EEZ.

Under Alternative 2, the predominant float surface drift would be to the south and southeast, with more limited opportunities to characterize complex surface conditions. In addition, floats would be outside of more heavily trafficked waters nearer the coast, limiting opportunities for maritime activity identification and tracking. Lastly, vessel transit time to initially deploy floats would increase compared to Alternative 1.

### 2.3.3 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur. The No Action Alternative represents the status quo, in which floats under the Ocean of Things program would not be deployed at sea. Implementing the No Action Alternative would impede development of cost-effective methods to fill a gap in regional high resolution and quality data that can be used to obtain near real-time situational awareness and calibrate and improve oceanographic models. Another cost of the No Action Alternative would be the Navy’s continued reliance on proprietary and/or classified sensors that cannot share data. The No Action Alternative would not meet the purpose of and need for the Proposed Action; however, as required by NEPA, the No Action Alternative is carried forward for analysis in this EA/OEA and provides a baseline for measuring the environmental consequences of the action alternatives.

## 2.4 Alternatives Considered but not Carried Forward for Detailed Analysis

Ocean surface environmental and anthropogenic activity data, including the capability to provide real-time maritime situational awareness and vessel detections, is currently being collected or has the capability of being collected through several different methods and/or technologies. These methods and technologies were considered but determined to not meet the purpose of and need for the project or would otherwise be infeasible as described below.

A significant factor in development of the Ocean of Things program is cost of obtaining environmental and anthropogenic activity information. The most accurate method of collecting this information is manned platforms, but there are several limitations with this approach. Specifically, platforms (manned or unmanned) collect information in their immediate vicinity, requiring a large number to collect information over a large area. Additionally, manned platforms cost multi-millions of dollars per day for localized information. The Ocean of Things program costs less than $100,000 per day to collect information over a large area. The cost savings combined with the amount of area covered provides significant capability for the Department of Defense and a multitude of other organizations as discussed previously.

In addition to other technologies, the program considered but dismissed other geographical alternatives as described below. The alternatives considered but not carried forward for detailed analysis are listed below in order of increasing level of resolution in data collected.

### 2.4.1 Geographic Alternatives

#### 2.4.1.1 Limited Geographic Area

Under this alternative, floats would have been allowed to drift but would automatically scuttle within specifically set boundaries over a small area (e.g., within the Navy's Southern California Range Complex). Consideration of this option led to the conclusion that the phenomena of interest extend across such boundaries, and that programmed scuttling within these areas would artificially constrain data gathering and limit the potential value of the program, without providing a corollary advantage. This alternative would also not provide a large enough Study Area to allow floats to persist for the proposed one-month test duration. An additional drawback would be that floats would be scuttled within a smaller area, increasing the concentration of float materials on the bottom. With the goal of the Ocean of Things program being to characterize the environment over a wider regional area rather than a single localized area, this alternative would not meet the purpose and need for the project.

#### 2.4.1.2 Study Areas in Other Geographic Locations

For this initial proposed test of the Ocean of Things floats by NIWC Pacific, the Pacific Ocean off southern California and Baja California was identified as the location that could best provide the conditions for success. This is due to its diversity of environments; likelihood of obtaining quality data to test the Ocean of Things programmatic requirements; and proximity to NIWC Pacific research, development, test, and evaluation (RDTE) facilities in San Diego and to other Navy support facilities (e.g., Navy-owned San Clemente Island).

This area provides not only relatively high levels of commercial and private vessel traffic, as well as military activity, for observation, but also contains an abundance of fishing and marine mammal activity. This activity combined with oceanographic patterns in this area provide a rich source of data. The multitude of currents and winds provide ideal conditions for ocean and weather forecasting observations to aid in development of improved oceanographic models. Further, this area of the Pacific Ocean is relatively well monitored by other research programs compared to many other ocean areas, providing valuable ground-truth data that is necessary to refine and validate the initial findings of the Ocean of Things program.

Although it is possible that future Ocean of Things tests could be conducted in other regions, proximity to NIWC Pacific RDTE facilities and personnel is needed for this early testing for acceptance testing and safe deployment of the floats by NIWC Pacific. Other geographic locations proximate to naval support facilities within or adjacent to the U.S. were considered, including areas in the Pacific Ocean, the Atlantic Ocean, and the Gulf of Mexico. Due to distance from the supporting NIWC Pacific RDTE facilities, however, these locations are considered impracticable for this phase of testing. Lastly, the ocean off southern California is unlikely to experience extreme weather events, such as hurricanes or strong weather fronts, that could occur along the Atlantic Coast, in the Gulf of Mexico, and around Hawaii, which could interfere with completion of the float testing period.

### 2.4.2 Alternatives with other Technologies and Methods

#### 2.4.2.1 Satellites

There are existing satellites that could be used or new satellites could be deployed; however, satellite sensors are high cost and low resolution in terms of detecting objects on the ocean or for sensing oceanographic data. This technology is capable of detecting the presence (from satellite imagery) and movements (from satellite tags) of vessels and whales (Baird et al. 2010; Fretwell et al. 2014; Cubaynes et al. 2018), but is not yet capable of detecting ocean currents, wave heights, or winds at high resolution. Therefore, this technology would not meet the purpose of and need for the project.

#### 2.4.2.2 High Frequency Radar

High frequency radar is more effective for measuring surface currents than satellites, but is limited to only collecting nearshore data because it is land based (http://cordc.ucsd.edu/projects/mapping/). The antennas for high frequency radar must be stationary so this technology cannot be deployed on buoys or vessels. Therefore, this technology would not meet the purpose of and need for the project.

#### 2.4.2.3 Fixed Arrays on Ocean Floors

Fixed arrays are installed on the ocean floor, which gives them a limited area of coverage and types of environmental data that can be collected. Therefore, this technology would not meet the purpose of and need for the project.

#### 2.4.2.4 Manned or Unmanned Vessels/Vehicles

Manned or unmanned vessels or vehicles are capable of deploying similar types of sensors as those that would be deployed in the floats described under the Proposed Action. However, the spatial coverage would be limited to substantially fewer locations (e.g., tens of vessels vs. thousands of floats) with manned vessels because they are substantially more expensive to operate and are limited in coverage to the area where the vessel is located at any given time. Autonomous underwater vehicles, including gliders, are used by the Naval Oceanographic Office (Gallaudet 2016), National Science Foundation's Ocean Observatories Initiative https://oceanobservatories.org/), and NOAA's Global Drifter Program (http://www.aoml.noaa.gov/phod/gdp/index.php) to collect oceanographic data, but these are similarly limited by spatial coverage and cost per unit to deploy. Therefore, this technology would not meet the purpose of and need for the project and does not provide a cost-effective method for data collection.

#### 2.4.2.5 Existing Buoy or Float Systems

Existing buoy or float programs have deployed buoys/floats that are designed to operate differently and to collect other types of data than the Ocean of Things program. The Ocean Observatories Initiative (https://oceanobservatories.org) has established cabled and buoyed sensor arrays, which also support data gathering by gliders, in select locations off New England and Pacific Northwest in the U.S. and at other locations worldwide, though not off southern California. As described previously in Section 1.4, a variety of technologies are deployed as part of the Southern California Coastal Ocean Observing System (http://sccoos.org/overview/). Ocean of Things, however, proposes a different technology (i.e., large numbers of free-drifting floats as opposed to cabled, moored, boat- or shore-based instrumentation or powered underwater gliders) to meet its purpose and need. Data from Ocean of Things would be available for comparison and integration with Southern California Coastal Ocean Observing System data, leading to a more comprehensive understanding of the region.

The Argo project (http://www.argo.ucsd.edu/) is a global array of 3,800 floats designed to measure temperature, salinity, and currents in the upper 2,000 meters of the ocean, to better understand the mechanisms driving large-scale climate changes. The Argo floats descend to programmed depths, drift and collect data at those depths, rise to the surface and transmit data via satellite, then repeat the cycle, operating for an average of 4 years. Each Argo float costs approximately $15,000; total costs are approximately doubled when data handling and project management costs are included. The Argo floats are non-recoverable. Compared to Ocean of Things, Argo provides a different technology to sample different (deeper) layers of the ocean, and Argo does not track vessels; Argo is substantially more expensive per unit float, but the floats are much more widely dispersed and sample vast, largely unknown areas of the ocean. Also, data products based on the global Argo float network are provided at 0.5 or 1 degree [55 or 111 km] resolution, which is insufficient resolution for the goals of the Ocean of Things program. As such, Argo is a fundamentally different project than Ocean of Things, using other technology to meet unique goals. DARPA's and the Navy's purpose and need for Ocean of Things is exceptional – intensive data gathering in the near-surface environment at higher spatial resolution than currently exists by hundreds of inexpensive floats – and could not be met by using Argo or another existing scientific research project.

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# 3 Affected Environment and Environmental Consequences

## 3.1 Overview

This chapter presents a description of the environmental resources and baseline conditions that could be affected from implementing any of the alternatives and an analysis of the potential direct and indirect effects of each alternative. The potential for effects defines the extent of the project action area, which may differ slightly depending on the resource. Cumulative impacts are discussed in Chapter 4, and other considerations required under NEPA, such as Coastal Zone Management, are provided in Chapter 5.

All potentially relevant environmental resource areas were initially considered for analysis in this EA/OEA. In compliance with NEPA, the CEQ, and Navy guidelines, the discussion of the affected environment (i.e., existing conditions) focuses only on those resource areas potentially subject to impacts. Additionally, the level of detail used in describing a resource is commensurate with the anticipated level of potential environmental impact.

"Significantly," as used in NEPA, requires considerations of both context and intensity. Context means that the significance of an action must be analyzed in several contexts such as society as a whole (e.g., human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of a proposed action. For instance, in the case of a site-specific action, significance would usually depend on the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant. Intensity refers to the severity or extent of the potential environmental impact, which can be thought of in terms of the potential amount of the likely change. In general, the more sensitive the context, the less intense a potential impact needs to be in order to be considered significant. Likewise, the less sensitive the context, the more intense a potential impact would be expected to be significant. Similar reasoning applies to the determination of significance under EO 12114, although the critical determination is whether the action would result in "significant harm" to a resource.

## 3.2 Resources Not Requiring Detailed Analysis

The potential impacts to the following resource areas are considered negligible or non-existent so they were not analyzed in detail in this EA/OEA.

**Cultural Resources:** The largest float would have a 2-dimensional area of 2.6 square feet when floating and 3.1 square feet when scuttled ("average" of all designs is 1.8 square feet when scuttled), and scuttling all of the up to 1,000 floats across an area of 765,560 square km would result in an average density of 1 float per 100 square km, affecting less than one billionth of the ocean bottom in the Study Area. Put in a terrestrial perspective, one child's kite has about the same footprint as one float, and the density of floats is equivalent to 10 kites within the City of San Diego. However, the ultimate distribution of scuttled floats would not be uniform. Although the average distance between floats is expected to increase over time, currents, especially submesoscale and mesoscale (10-100 km) eddies and convergence zones (D'Asaro et al., 2018) – as are likely in the Study Area, could result in some percentage (which is unknown) of the floats drifting together and forming clusters that persist for days. Locations where this might occur are not predictable, being dependent on initial drop locations and seasonal and episodic conditions.

In any case, the possibility that a scuttled float would land on a submerged cultural resource (i.e., shipwreck) is extremely remote, and given the small size, surface area, and mass of the floats, they would sink slowly and would be unlikely to affect a durable object such as a shipwreck on the seabed. Due to their small size and the scuttling of floats at least 12 NM from shore, the Proposed Action has no potential to affect American Indian (Chumash) historic properties or traditional resource uses and activities.

**Visual Resources:** Float designs have a low profile, and the antenna would have negligible wind resistance, limiting their susceptibility to wind-driven motion. Floats on the ocean surface would only be discernable at close range. Floats would initially be 150-200 meters apart, and the distance between floats is expected to increase during the one-month test period, although as noted above, clusters of floats could form, temporarily making them more conspicuous. Regardless, the presence on the open ocean of floating scientific instruments that would be rarely glimpsed would not be incompatible with or degrade the visual quality within the Study Area. Float scuttling seaward of 12 NM of any shoreline would prevent the accumulation of floats on a beach. Given these considerations – limited visibility of individual floats, their lack of aggregation, and distance from shore, the impact on visual resources would be negligible.

**Noise:** The only noise associated with the Proposed Action would be from the M/V Diane G or a similar vessel during float deployment. Transient noise from Navy and other vessels is routine throughout the region, and the activity of the M/V Diane G or a similar vessel has a negligible likelihood of significant effect on human or animal receptors.

**Transportation:** The Proposed Action would have no effect on land or water transportation. The low density of floats, their small size and weight, and routine watch by mariners for floating objects indicate that the risk of damage from a vessel collision would be minimal.

**Hazardous Materials and Waste:** During float deployment, the floats would be mechanically dropped, not launched using propellants or explosives; no chemical residues would be generated. The M/V Diane G or a similar vessel would operate in compliance with Chapter 35 (Environmental Compliance Afloat) of the Navy Environmental Program Manual (OPNAVM-5090.1), ensuring that the ship's activities would not be a source of hazardous materials, and that any waste generated during deployment is properly handled and disposed of. The floats would not contain hazardous materials (no materials used, including the spent lithium ion batteries in the floats, meet the characteristics of hazardous waste as defined in 40 CFR Part 261, Subpart C, including ignitability, corrosivity, reactivity, and toxicity), and upon scuttling would lodge and/or bury on the ocean bottom in deep water, become encrusted with marine growth, and gradually disintegrate, resulting in negligible changes to benthic habitat, water quality and sediment properties (refer to sections 3.3 and 3.4 below). Accordingly, no further analysis of hazardous materials and wastes is necessary for the Proposed Action.

**Socioeconomics:** The Proposed Action would not increase the cost or availability of services provided by local governments and businesses, and would not affect housing or employment opportunities in the region. It is unlikely that a float, if struck, would damage a vessel, and any float attachments would be weighted and suspended vertically so chances of entanglement in fishing gear or propellers would be minimal. Based on the large size of the project area, the very low density of floats (regardless of the possibility of clustering as noted above), and the use of Notices to Mariners to alert the public, any interaction with commercial or recreational fishing would be rare, and if it were to occur, would have a negligible impact on fishing industries. Accordingly, the Proposed Action would have no significant socioeconomic impacts and no further analysis of socioeconomics is necessary.

**Environmental Justice:** The Proposed Action would not affect minority or low-income populations. Therefore, no further analysis of Environmental Justice is necessary.

**Air Quality**. The Proposed Action would occur in the waters offshore from San Diego County (San Diego Air Basin). The local agency responsible for enforcement of air quality regulations within this area is the San Diego Air Pollution Control District. Under the Clean Air Act (CAA), the U.S. Environmental Protection Agency (USEPA) has established National Ambient Air Quality Standards (NAAQS) (40 CFR part 50) for criteria pollutants, while the California Air Resources Board (CARB) establishes the state standards, termed the California Ambient Air Quality Standards (CAAQS) (CARB 2016). The USEPA has classified San Diego County as a moderate nonattainment area for the 8-hour ozone ($O_3$) NAAQS (USEPA 2018). Additionally, the San Diego Air Basin is classified as a nonattainment area for the $O_3$ and suspended particulate matter less than or equal to 10 microns in diameter ($PM_{10}$), and fine particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$) CAAQS. The air basin is either unclassified or in attainment of the CAAQS for all other criteria pollutants (CARB 2018). Due to the nonattainment status of these criteria pollutants within the air basin, USEPA has determined *de minimis* thresholds to define the limit at which a formal Conformity Determination under the CAA General Conformity Rule would be required.

Although the action alternatives are considered to have relatively minor effects, and associated criteria pollutant emissions would not substantially contribute to air basin pollution, a quantitative analysis was conducted for comparison with the applicable *de minimis* threshold levels. Due to the potential for emissions to travel from offshore to onshore regions, the analysis conservatively assumes the worst-case scenario of 100 percent of emissions from the Proposed Action occurring within U.S. territorial waters (out to 12 NM) would directly impact the air basin. Offshore emissions were modeled using emissions factors published by the USEPA (2009), assuming a vessel operating for up to three roundtrips for a maximum of 6 days at 2 hours per day. This includes travel from NBPL in San Diego County after loading the floats on to the vessel, travel in U.S. territorial waters to deploy the floats, and the return trip after the floats are deployed under each action alternative.

Tables 3.2-1 presents estimated emissions from the implementation of the Proposed Action, assuming the entirety of the emissions from the offshore deployment of the floats impacted the San Diego Air Basin by 100 percent of those emissions blowing onshore. The emissions calculations are presented in Appendix B. Based on this quantitative analysis, emissions from the action alternatives would be below *de minimis* thresholds and would not require a formal Conformity Determination under the CAA. Therefore, implementation of either Alternative 1 or Alternative 2 would result in negligible impacts to air quality, and would not harm the U.S. EEZ as defined by EO 12114. Accordingly, air quality is not carried forward for detailed analysis in this EA/OEA.

## 3.3 Marine Biological Resources

Marine biological resources include living, native, or naturalized plant and animal species inhabiting the marine environment, and the habitats within which they occur. Species are grouped into higher taxonomic categories that reflect their evolutionary relationships, as well as morphological, physiological, and ecological attributes. Habitat can be defined as the resources and conditions present in an area that support a plant or animal.

**Table 3.2-1 Annual Peak Estimated Emissions from the Proposed Action in the San Diego Air Basin**

| *Emission Source* | *Emissions (tons per year)* | | | | | | |
|---|---|---|---|---|---|---|---|
| | *VOCs* | *$NO_x$* | *CO* | *$SO_2$* | *$PM_{10}$* | *$PM_{2.5}$* | *Pb* |
| **Proposed Project Emissions within the San Diego County Air Pollution Control District - 2019** | | | | | | | |
| Vessel Emissions | 0.002 | 0.059 | 0.005 | 0.018 | 0.002 | 0.002 | -- |
| Significance Thresholds | 100 | 100 | N/A | N/A | N/A | N/A | N/A |
| Exceeds Air Quality Significance Threshold Standards? | No | No | N/A | N/A | N/A | N/A | N/A |

*Notes*: CO = carbon monoxide; NOx = nitrogen oxides; Pb = lead; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter; $PM_{10}$ = particulate matter less than 10 microns in diameter but greater than 2.5 microns in diameter; $SO_2$ = sulfur dioxide; VOCs = volatile organic compounds.
The San Diego Air Basin is a moderate nonattainment area for the 8-hour $O_3$ NAAQS (VOCs and NOx are precursors to the formation of $O_3$). Pb emissions factors were not available for the vessel used in the Proposed Action.
N/A = Not applicable because the San Diego Air Basin is currently in attainment of the NAAQS for these criteria pollutants.

Within this EA/OEA, marine biological resources are divided into six major categories: (1) Marine Habitats and Vegetation; (2) Invertebrates; (3) Fishes and Essential Fish Habitat (EFH); (4) Sea Turtles; (5) Seabirds; and (6) Marine Mammals. Species listed as threatened or endangered under the ESA, and other special status species (those afforded specific regulatory considerations) are discussed as applicable in their respective categories.

### 3.3.1 Regulatory Setting

The regulatory setting for marine biological resources includes special status species and habitats that are afforded special consideration. These resources include species listed as threatened or endangered under the ESA and other species afforded federal protection under the MMPA and the MBTA, as well as the habitats that support these species. EFH is afforded special consideration under the MSA. These requirements are described below.

The purpose of the ESA is to conserve the ecosystems upon which threatened and endangered species depend and to conserve and recover listed species. Section 7 of the ESA requires action proponents to consult with the USFWS and/or NMFS to ensure that their actions are not likely to jeopardize the continued existence of federally listed threatened and endangered species, or result in the destruction or adverse modification of designated critical habitat.

All marine mammals are protected under the provisions of the MMPA. The MMPA prohibits any person or vessel from “taking” marine mammals in the United States or the high seas without authorization. The MMPA defines “take” to mean, “to harass, hunt, capture, or kill or attempt to harass, hunt, capture, or kill any marine mammal.”

Birds, both migratory and most native-resident bird species, are protected under the MBTA, and their conservation by federal agencies is mandated by EO 13186 (Migratory Bird Conservation). Under the MBTA, it is unlawful by any means or in any manner, to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, [or] possess migratory birds or their nests or eggs at any time, unless permitted by regulation. The final rule authorizing the 2003 National Defense Authorization Act requires that the

Armed Forces must confer with the USFWS to develop and implement appropriate conservation measures to minimize or mitigate adverse effects of proposed military readiness activities if the action will have a significant negative effect on the sustainability of a population of a migratory bird species.

The MSA provides for the conservation and management of fisheries and Essential Fish Habitat (EFH). Consultation with NMFS is required for any federal action that may adversely affect EFH. The definition of adverse effect is "any impact that reduces the quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate" (CFR 600.910[a]).

### 3.3.2 Affected Environment

The following discussions provide a description of the existing conditions for each of the categories under biological resources of the action area. The Study Area for the proposed Ocean of Things program Phase 1a includes the Pacific Ocean off southern California and Baja California, generally south of the Channel Islands and extending offshore in the Pacific Ocean (Figure 2-1). Floats would be initially deployed in the Navy's Southern California Range Complex and allowed to drift for one month, or until they approach a geofence where they would scuttle seaward of 12 NM of any shoreline, or at the boundaries of the Study Area, or at the mock islands (Figure 2-1). Automatic float scuttling would occur if any of these conditions are met or if floats lose critical capabilities (e.g., GPS or communications) for an extended period. Most of the Alternative 1 Study Area is outside of the U.S. EEZ, on the global commons of the high seas or overlapping the Mexico EEZ. The Alternative 2 Study Area would be the same as Alternative 1 except it would exclude all of the continental shelf (Figure 2-1). Threatened and endangered species are discussed as applicable in each respective section below.

#### 3.3.2.1 Marine Habitats and Vegetation

Marine habitats include the water surface and water column, and the seafloor. Water column habitat is generally classified on the basis of temperature, depth, and exposure to sunlight (Section 3.4.2.2, *Water Quality*). Benthic habitats on the seafloor are further classified on the basis of substrate as hard, intermediate, or soft bottom. Figure 3-1 shows the distribution of these substrate categories throughout the action area. Hard substrate habitats include rocky reef, and deep-water corals and sponges (Figure 3-2). Best available data are shown in Figure 3-2, but note that data are not available for all of the Study Area, particularly outside the U.S. EEZ, and data are not necessarily comprehensive within the U.S. EEZ.

All nearshore habitats are specifically excluded from the Study Area and floats would be scuttled well before entering these habitats within 12 NM of the shoreline. Kelp beds, seagrass, and estuarine habitats do not occur in the Study Area because nearly all of these high-value submerged aquatic vegetation habitats occur within 0.5 miles (1 km) from shore, and none occur adjacent to the Study Area boundary 12 NM offshore (22 km) (Figure 3-3, shown at an exaggerated scale to improve visibility). Best available data are shown in Figure 3-3, but note that data are not available for all of the Study Area, particularly outside the U.S. EEZ, and data are not necessarily comprehensive within the U.S .EEZ.

Floats approaching the Study Area boundary would be scuttled well before entering adjacent habitats. It is possible that a float would fail to scuttle, and it is possible that the failed float could enter habitats within 12 NM of the shoreline. However, potential effects to kelp, seagrass, or estuarine habitats are not discussed in detail because measures would be implemented to minimize potential for any floats to travel beyond the Study Area boundary (see Section 2.1.3).

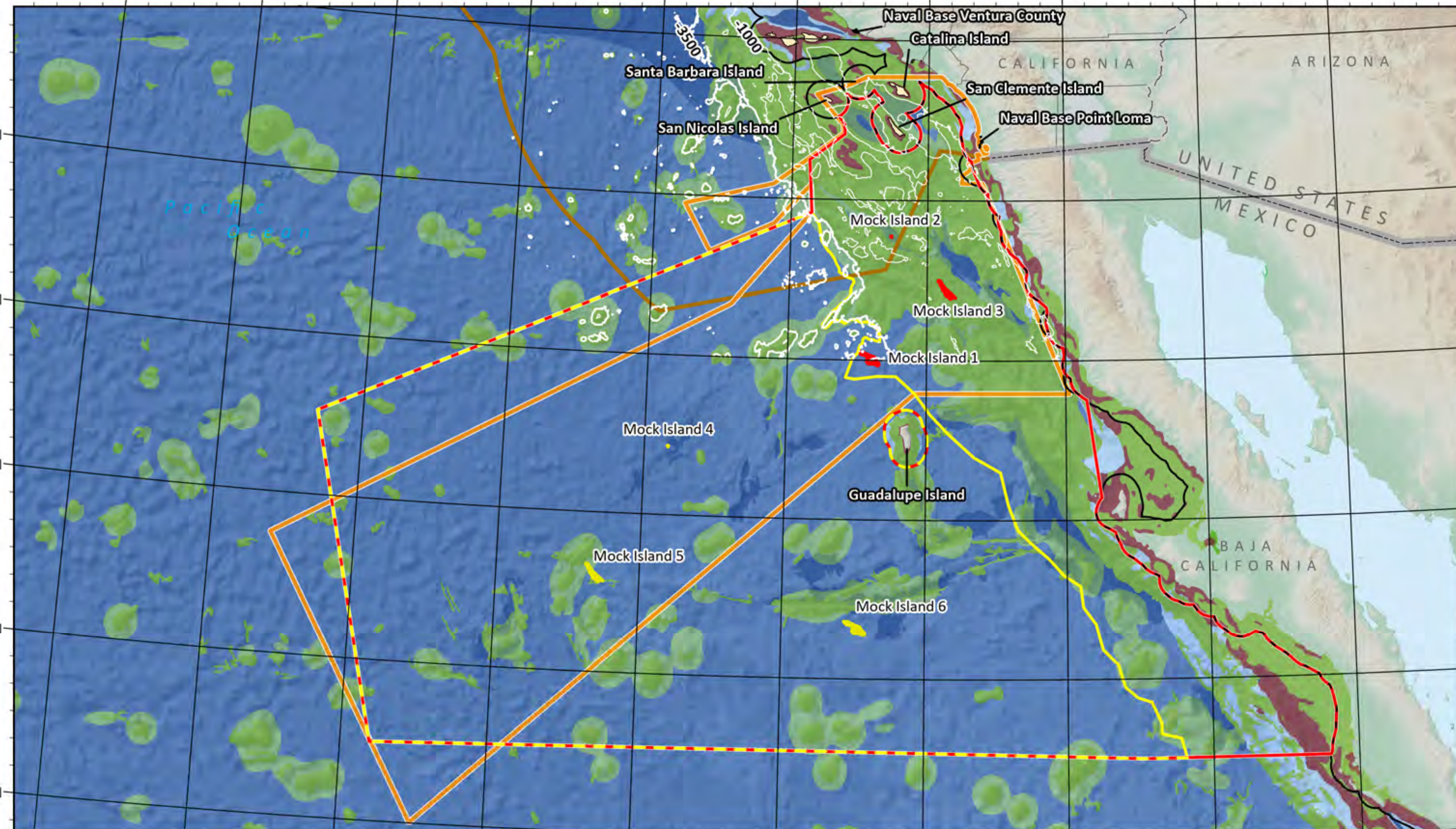
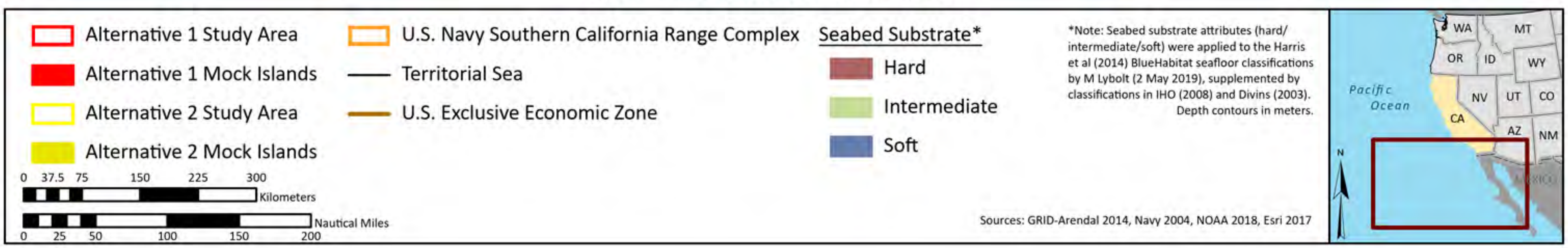



**Figure 3-1. Substrate and Bathymetry**



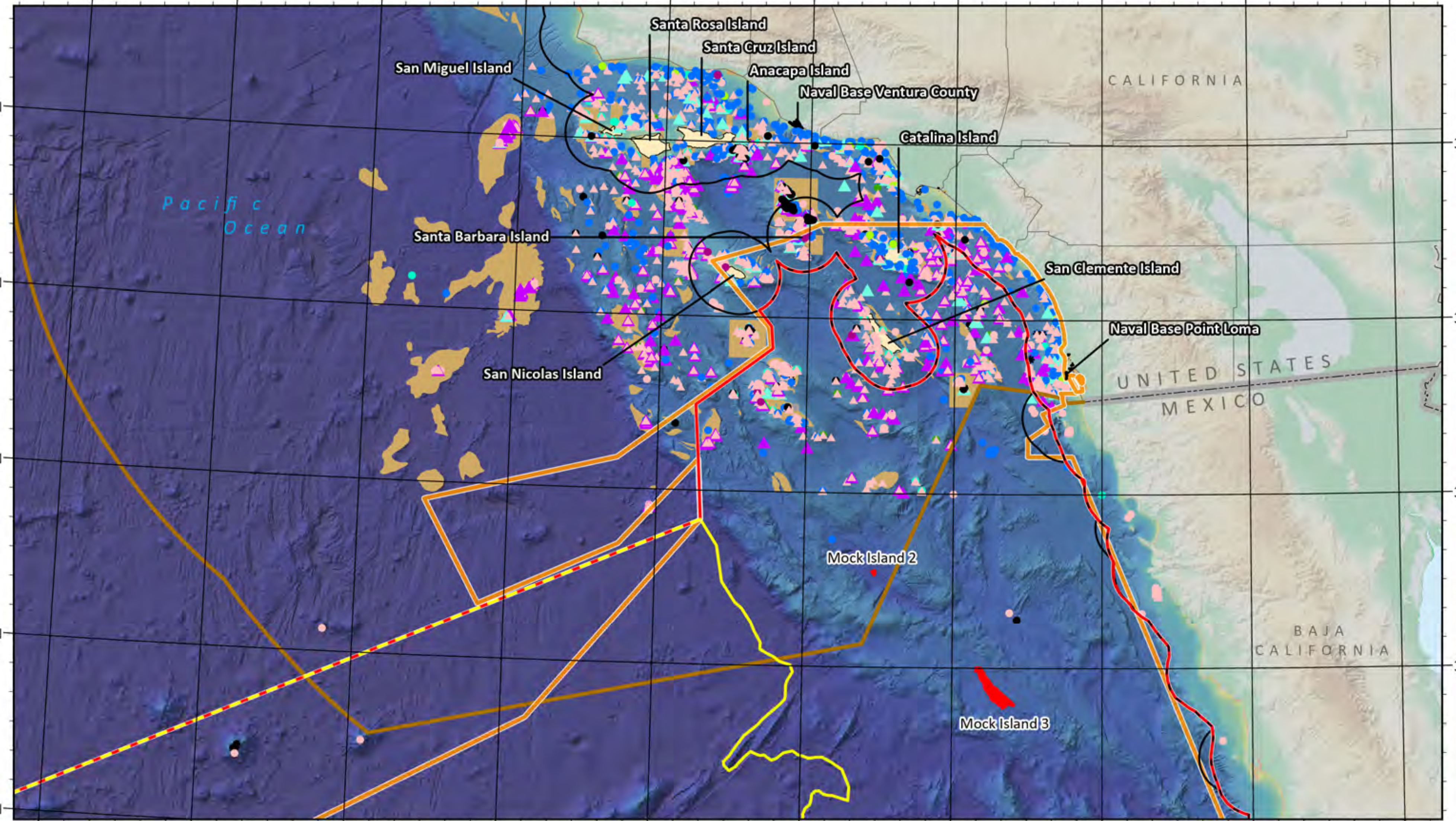
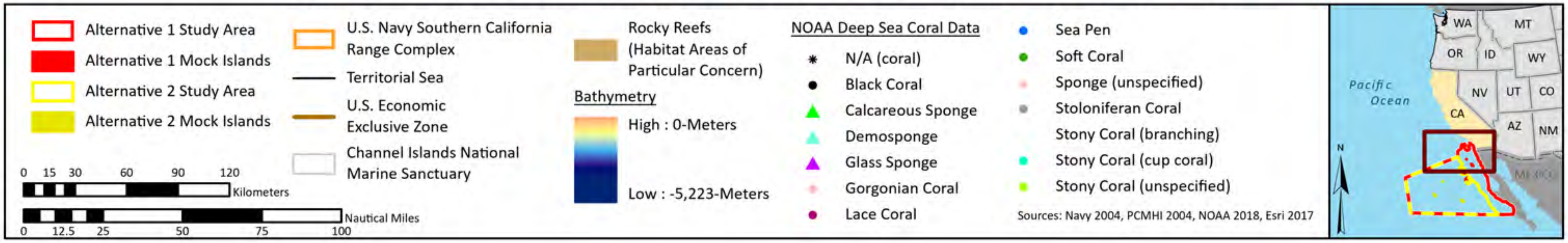



Figure 3-2. Deep Sea Corals, Sponges, and Rocky Reefs in the Vicinity of the Proposed Action



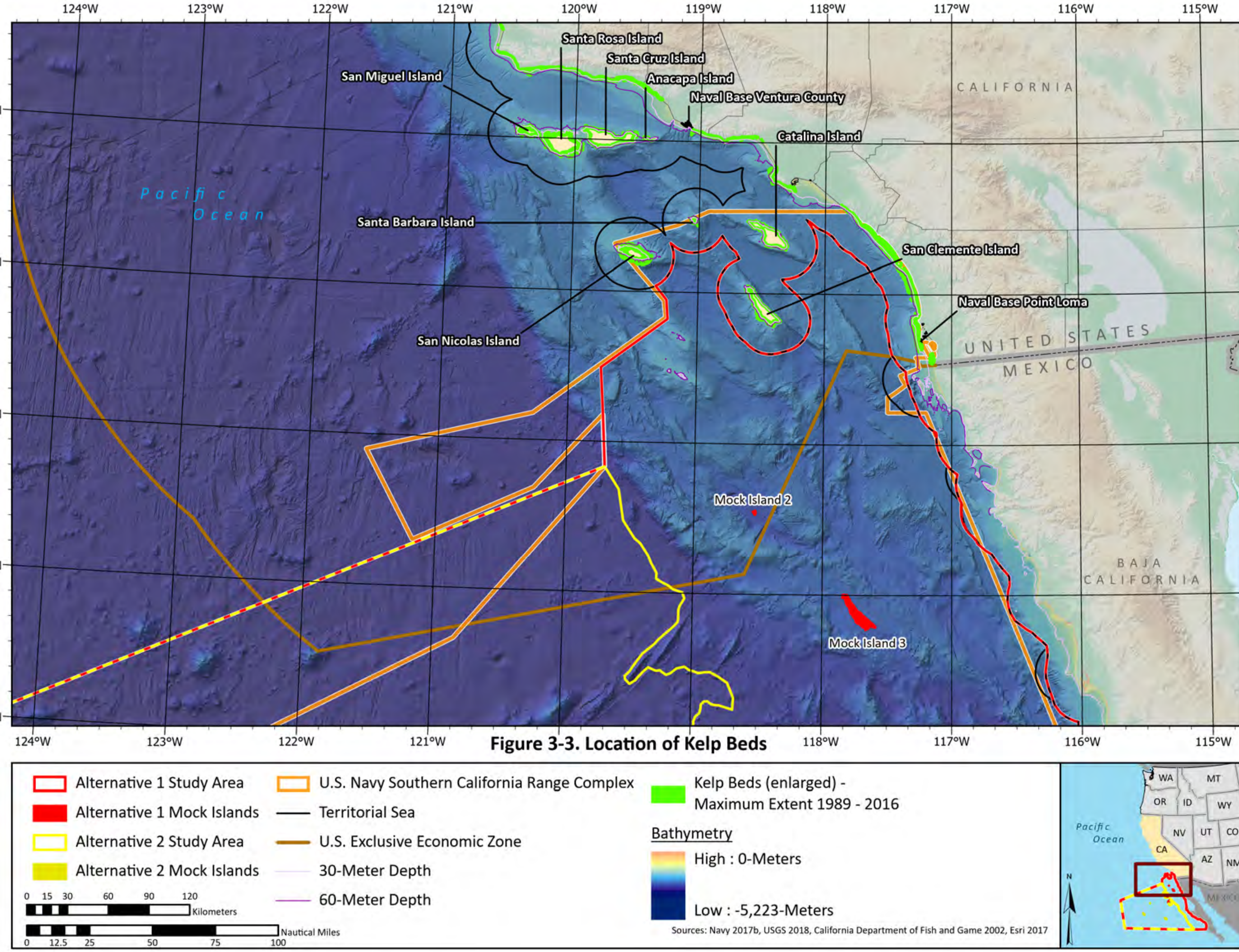



**Figure 3-3. Location of Kelp Beds**

Water column habitat occurs throughout the action area. The main physical attributes of water column habitat are temperature, depth, and exposure to sunlight (Section 3.4.2.2, *Water Quality*). Most marine organisms use water column habitat for all or part of their life cycle. The assemblages of marine organisms are also strongly influenced by gyres and eddies, upwelling and nutrient levels, and light intensity. Episodic and seasonal changes of these attributes combine in the SCB to produce exceptionally high primary production that supports large numbers of fish, shellfish, and other marine life (Dong et al. 2009).

Benthic habitat occurs throughout the action area. The majority of benthic habitat in the Study Area is soft bottom (Figure 3-1, Figure 3-2). Soft bottom habitat hosts a very high diversity of marine invertebrates living on or in the sediments (Allen and Cross 2006; Chess and Hobson 1997; Dugan et al. 2000; Kalvass 2001; Smith and Hamilton 1983). Hard substrate habitats occur in a minority of the Study Area, but are noteworthy for biogenic hard substrate habitat (e.g., sponge, coral, worms, bivalves), and for hard substrates' disproportionately large contribution to fishery productivity (Center for Ocean Solutions 2009; Clarke et al. 2017; Love and Yoklavich 2006; Stephens et al. 2006). The relative distribution of benthic habitat categories throughout the action area is depicted in Figure 3-1 and Figure 3-2.

Vegetation within the action area includes the free-floating microscopic algae constituting the phytoplankton, and macroscopic (visible to the eye) algae, referred to as macroalgae, that grow attached to firm substrates or as free-floating rafts. Phytoplankton would be unaffected by the drifting floats and so do not require further description. Kelp paddies are free-floating rafts of kelp that drift after being dislodged from the bottom, typically by large waves during seasonal storms. Kelp paddies provide a pelagic habitat and the possibility of dispersal for the kelp and associated fauna, and often attract invertebrates, fishes, sea turtles, and marine mammals. Kelp paddies that drift offshore can continue to float before beaching or sinking for up to approximately 109 days and can travel over 1,000 km (Hernandez-Carmona et al. 2006). The density of kelp paddies in the SCB has been measured as 0.78 to 6.96 per square km, with an average diameter of 1.9 to 3.3 m, and the largest rafts reaching a diameter of 10 meters (Hobday 2000). Extrapolating these, Hobday (2000) estimates 39,000 to 348,000 drifting kelp paddies in a 50,000 square km area of the SCB. Other types of benthic macroalgae grow on hard or stable substrate to the limit of light penetration which, depending on water clarity, can extend to depths as great as 200 m. As a result, a relatively small portion of the Study Area (Figure 3-1) constitutes habitat for macroalgae.

### 3.3.2.2 Invertebrates

Invertebrates are animals that lack a backbone; marine invertebrates include both benthic (bottom-dwelling) and planktonic (free-floating or swimming) forms. Zooplankton would drift/swim amid the floats in the same water masses, with no differential movement that would produce "collisions" that could damage the larger zooplankton. Any lines would be vertically weighted and would not whip back and forth or be prone to looping in a way that might break up the larger forms of zooplankton (jellyfish, colonial salps). Therefore, no impacts to zooplankton would occur and they will not be discussed further.

It is estimated that more than 5,000 marine invertebrate species can be found in the SCB (Dailey et al. 1993). Typical benthic invertebrates include sea anemones, sponges, corals, sea stars, sea urchins, worms, bivalves, crabs, and many more (Dugan et al. 2000; Chess and Hobson 1997; Kalvass 2001).

There is increasing research into the species diversity, ecological importance (as biogenic EFH), and fragility of coral and sponge communities in deep-water (Hourigan et al. 2017). These communities consist of sessile and relatively brittle marine invertebrates that are susceptible to injury from physical contact (e.g., upright and/or branching forms of deep-water corals or glass sponges). These communities occur predominantly on rocky substrate (Clarke et al. 2017). Figure 3-2 shows documented occurrences of deep-water corals and sponges in the project area, along with rocky reef, an important subcategory of EFH for groundfish (see section 3.3.2.3), as mapped in the project area by NMFS (2018a, b).

EFH for marine invertebrate fisheries is discussed separately in the EFH Assessment (submitted to NMFS). In summary, only the Coastal Pelagic Species fisheries management plan has EFH and managed marine invertebrate fisheries in the Study Area (e.g., krill). No adult life stages of benthic marine invertebrate species are managed fisheries with EFH in the Study Area (i.e., there are no Olympia oysters, Pacific razor clams, gaper clams, Washington clams, littleneck clams, blue mussels). Managed fishery species with EFH in the Study area are consolidated into Table 3.3-1.

The endangered white abalone (*Haliotis sorenseni*) was once fairly common from Point Conception to Punta Abreojos, Baja California, occurring on rocky bottom in depths of 20-60 m. It is now known to occur in extremely low numbers along the mainland coast of southern California, and at a few offshore islands and banks, including the west side of San Clemente Island and at the Tanner and Cortes Banks (NMFS 2018c; Butler et al. 2006). No other ESA-listed marine invertebrate species occur in the Study Area. The endangered black abalone (*Haliotis cracherodii*) occurs within 0.5 miles (1 km) from shore, and extensive surveys found no black abalone at Tanner and Cortez banks (NMFS 2018c; Butler et al. 2006). Potential effects to abalone or their habitats are not discussed in detail because measures would be implemented to minimize potential for any floats to travel beyond the Study Area boundary (see Section 2.1.3).

#### 3.3.2.3 Fishes

Fish are vital components of the marine ecosystem and have great ecological and economic benefits. To protect this resource, NMFS works with the regional fishery management councils to identify the essential habitat for every life stage of each federally managed species using the best available scientific information. EFH has been described for approximately 1,000 managed species to date. EFH includes all types of aquatic habitat including wetlands, coral reefs, seagrasses, and rivers; all locations where fish spawn, breed, feed, or grow to maturity.

Of the 519 recognized California marine fish species there are at least 481 species within the greater SCB south of Point Conception (Horn 1980; Cross and Allen 1993; Horn et al. 2006). Geographical variation of both larval and adult fish distribution within the SCB is strongly related to depth preference, warm- or cold-water affinities of each particular fish species, and water mass influences associated with ocean circulation patterns (Cross and Allen 1993; Horn et al. 2006). Occasional climatic level shifts in ocean mass, resulting from El Niño and La Niña events, can directly influence either warm- or cold-water species composition during any given year.

Pelagic fishes, including coastal pelagic and highly migratory fish species, inhabit the open water above the bottom for all or part of their life cycle. Because there is no consequential mechanism for pelagic fishes to interact with small passive floats in the pelagic environment, pelagic fishes do not need more detailed descriptions.

Fish assemblages in kelp bed and shallow rocky-reef habitats are higher diversity and abundance than most other California marine habitats (Stephens et al. 2006). The spatial extents of kelp bed and shallow rocky-reef habitats are a small proportion of the continental shelf, as shown in Figure 3-2 and Figure 3-3. Kelp bed and shallow rocky-reef habitats are specifically excluded from the Study Area and floats would be scuttled well before entering these habitats. But it is possible that a float would fail, and the failed float could enter kelp bed or shallow rocky-reef habitats. Because this scenario is conceivable but unlikely, fishes in kelp bed and shallow rocky-reef habitats do not need more detailed descriptions.

Fishes that associate with deep rocky habitat (i.e., species below SCUBA depths, typically greater than 30 m) are difficult and expensive to survey; therefore, relatively little is known of fish assemblages associated with this habitat type. However, it is commonly accepted that rockfishes dominate fish assemblages of deep rocky habitat. Yoklavich et al. (2002) identified 95 percent of all fishes surveyed at water depths of 30 to 100 meters as rockfish and 64 percent of fishes at depths of 100 to 250 meters as rockfish. In general, species diversity is highest off southern California and decreases to the north and south (Love and Yoklavich 2006). Rockfish diversity also increased in mixed habitats of complex rock and mud (Yoklavich et al. 2000) and generally with water depth (Yoklavich et al. 2002).

The soft bottom habitat is the dominant habitat of the shelf and upper slope (Figure 3-1; Allen and Cross 2006). This habitat comprises more than 50 percent (probably from 70 percent to more than 90 percent) of the California shelf area (Allen and Cross 2006). Of the 40 major species comprising the soft bottom fish community of the southern California shelf, 42 percent burrow into sediments, 38 percent are exposed to the bottom, 10 percent are in schools, and 10 percent are in crevices (Allen 1982). Species likely to burrow into sediments include flat fishes, benthic roundfishes, and eel-like fishes. Many species exposed in the open water either rely on spines or armor for protection or are difficult to find at night (Allen and Cross 2006).

The California slope and rise (550 to 2,000 m) is dominated by benthic and benthopelagic fishes. The longspine thornyhead (*Sebastolobus altivelis*) is the most abundant benthic fish in the SCB and is uniformly distributed (Smith and Hamilton 1983). Black hagfish (*Eptatretus deani*) and smooth grenadier (*Nezumia liolepis*) are likely next in abundance (Neighbors and Wilson 2006).

Essential Fish Habitat for marine fishes are discussed separately in an Essential Fish Habitat Assessment. In summary, the Study Area includes EFH and managed species under the Coastal Pelagic Species, Highly Migratory Species, and Pacific Coast Groundfish fishery management plans (Table 3.3-1) (Pacific Fishery Management Council [PFMC] 2016a, 2016b, 2016c). The Study Area includes one Habitat Area of Particular Concern (HAPC) for Pacific Coast Groundfish: rocky reef habitat (PFMC 2016c). No HAPCs have been identified for Coastal Pelagic Species or Highly Migratory Species. EFH occurs in less than 2 percent of the Phase 1a Alternative 1 Study Area, and in nearly 0 percent of the Alternative 2 Study Area (Figure 3-2). Additional detail on EFH and HAPC is provided in an Essential Fish Habitat Assessment (submitted separately to NMFS).

Five ESA-listed fish species occur in the project area. These include the Eastern Pacific distinct population segment of the scalloped hammerhead shark (*Sphyrna, lewini*, endangered), the southern California distinct population segment of steelhead (*Oncorhynchus mykiss*, endangered), the gulf grouper (*Mycteroperca jordani*, endangered), the giant manta (*Manta birostris*, threatened), and the oceanic whitetip shark (*Carcharhinus longimanus*, threatened). There is no designated critical habitat for any of these species in areas potentially affected by the project. Background information on these species as they occur in the project area is provided in the HSTT EIS/OEIS (Navy 2018a).

**Table 3.3-1 Managed Fishery Species Known to Occur in the Proposed Action Area**

| ***Common Name*** | ***Scientific Name*** |
|---|---|
| **Coastal Pelagic Species** | |
| Northern anchovy | *Engraulis mordax* |
| Pacific sardine | *Sardinops sagax* |
| Pacific (chub) mackerel | *Scomber japonicus* |
| Jack mackerel | *Trachurus symmetricus* |
| Market squid | *Doryteuthis opalescens* |
| Krill | Euphausiidae (8 species) |
| **Highly Migratory Species** | |
| North Pacific albacore | *Thunnus alalunga* |
| Bigeye tuna | *Thunnus obesus* |
| Bluefin tuna | *Thunnus orientalis* |
| Skipjack tuna | *Katsuwonus pelamis* |
| Yellowfin tuna | *Thunnus albacares* |
| Thresher sharks | Family Alophiidae (3 species) |
| Striped marlin | *Tetrapturus audax* |
| Shortfin mako shark | *Isurus oxyrinchus* |
| Blue shark | *Prionace glauca* |
| Swordfish | *Xiphias gladius* |
| Dorado | *Coryphaena hippurus* |
| **Groundfish** | |
| Skate (big and/or longnose) | *Raja* spp. |
| Leopard shark | *Triakis semifasciata* |
| Spiny dogfish | *Squalus acanthias* |
| Sablefish | *Anoplopoma fimbria* |
| Lingcod | *Ophiodon elongatus* |
| Cabezon | *Scorpaenichthys marmoratus* |
| Pacific whiting (hake) | *Merluccius productus* |
| Black and yellow rockfish | *Sebastes atrovirens* |
| Blue rockfish | *Sebastes mystinus* |
| Boccacio | *Sebastes paucispinis* |
| Brown rockfish | *Sebastes auriculatus* |
| Copper rockfish | *Sebastes caurinus* |
| Gopher rockfish | *Sebastes carnatus* |
| Grass rockfish | *Sebastes rastrelliger* |
| Kelp rockfish | *Sebastes atrovirens* |
| Longspine thornyhead | *Sebastolobus altivelis* |
| Olive rockfish | *Sebastes serranoides* |
| Rosy rockfish | *Sebastes rosaceus* |
| Shortbelly rockfish | *Sebastes jordani* |
| Shortspine thornyhead | *Sebastolobus alascanus* |
| Starry rockfish | *Sebastes constellatus* |
| Treefish | *Sebastes serriceps* |
| Vermilion rockfish | *Sebastes miniatus* |
| Widow rockfish | *Sebastes entomelas* |
| Dover sole | *Solea* |
| Petrale sole | *Eopsetta jordani* |
| Rex sole | *Glyptocephalus zachirus* |

*Sources:* Navy 2013b; PFMC 2016a, 2016b, 2016c.

#### 3.3.2.4 Sea Turtles

Of the six sea turtle species that are found in U.S. waters or that nest on U.S. beaches, all are designated as either threatened or endangered under the ESA. Sea turtles are highly migratory and utilize the waters of more than one country in their lifetimes. The USFWS and NMFS share jurisdiction, with the USFWS having lead responsibility for sea turtles on the nesting beaches and NMFS having lead responsibility for sea turtles in the marine environment. Four species of sea turtles have been reported in the SCB and are expected, either in transit or foraging on drifting algae and invertebrates, in the open waters of project area: the loggerhead sea turtle (*Caretta caretta*), olive ridley turtle (*Lepodochelys olivacea*), leatherback turtle (*Dermochelys coriacea*), and east Pacific green sea turtle (*Chelonia mydas*). There are no known sea turtle nesting beaches on the U.S. West Coast and none of the Channel Islands is considered a concentration area or destination for sea turtles, although sea turtles are frequently sighted around the islands (Office of National Marine Sanctuaries 2009). Sea turtle abundance in the SCB is greatest during summer-fall months and warm water/El Niño periods (Navy 2017b). A recent study estimated that during 2015 (an El Niño year), 70,000 juvenile and young adult loggerhead sea turtles dispersed northward and offshore from traditional foraging grounds off the Baja California peninsula into the SCB, with many sightings reported off San Diego (Eguchi et al. 2018). Background information on these species as they occur in the project area is provided in the HSTT EIS/OEIS (Navy 2017b, 2018a).

#### 3.3.2.5 Seabirds

Seabirds – birds that forage primarily on the open ocean, together with sea ducks (scoters), loons, and grebes, are the primary users of the offshore waters of the SCB (Baird 1993). These birds (as opposed to terrestrial and nearshore coastal species) are of primary interest because of their occurrence throughout the Ocean of Things project area. Seabirds are a diverse group that are adapted to living in aquatic environments (Enticott and Tipling 1997) and, in the Study Area use coastal (nearshore) waters, offshore waters (continental shelf), or open ocean areas (Harrison 1983). There are many biological, physical, and behavioral adaptations that are different for seabirds than for terrestrial birds. Seabirds typically live longer, breed later in life, and produce fewer young than other bird species (Onley and Scofield 2007). The feeding habits of seabirds are related to their individual physical characteristics, such as body mass, bill shape, and wing area (Hertel and Ballance 1999). Some seabirds look for food (forage) on the sea surface, whereas others dive to variable depths to obtain prey (Burger 2001). Many seabirds spend most of their lives at sea and come to land only to breed, nest, and occasionally rest (Schreiber and Chovan 1986). Most species nest in groups (colonies) on the ground of coastal areas or oceanic islands, where breeding colonies number from a few individuals to thousands. However, many species are distributed nesters, and some seabirds/waterbirds are cavity nesters. Typical bird behavior to be encountered within the action area would include breeding, foraging, roosting, and migration. Beaches and wetlands within or bordering the action area may also be used as molting grounds by some species.

Forty-three species of seabirds regularly occur in the SCB and at least 11 more species occasionally occur, the most abundant being shearwaters, stormpetrels, phalaropes, gulls, terns, and auklets. Other groups of seabirds that are represented in the SCB include loons, grebes, albatrosses, scoters, fulmars, pelicans, cormorants, kittiwakes, guillemots, murrelets, and murres (Baird 1993; Mason et al. 2007). Species descriptions and distribution maps can be found in Sibley (2014). Baird (1993) provides details on seasonal occurrence, breeding colony locations on the mainland and offshore islands, and maps of the most heavily used foraging areas in the SCB. Mason et al. (2007) provide at-sea distributions and densities of species observed in aerial surveys conducted during January, May, and September from 1999-2002.

ESA-listed bird species that may occur in the SCB action area are listed in Table 3.3-2.

**Table 3.3-2 Endangered Species Act-Listed Bird Species Found in Waters off Southern California**

| *Species Name and ESA Status* | | | *Presence in Action Area*[1] |
|---|---|---|---|
| ***Common Name*** | ***Scientific Name*** | ***ESA Status*** | |
| California least tern | *Sternula antillarum browni* | Endangered | Inshore ocean waters, bays, and harbors; mostly < 1 km offshore, mainland only |
| Short-tailed albatross | *Phoebastria albatrus* | Endangered | Open ocean > 1 km offshore |
| Marbled murrelet | *Brachyramphus marmoratus* | Threatened | Rare visitor; most likely < 5 km offshore |

*Note*: [1] Summarized from Baird 1993; Mason et al. 2007; and Navy 2018a.

Birds of Conservation Concern are species, subspecies, and populations of migratory and non-migratory birds that the USFWS has determined to be the highest priority for conservation actions to avoid the need for ESA protection (USFWS 2008). Most of the bird species that may be encountered in the project area are listed under the MBTA (USFWS 2019). Consequently, there is no reason to separate the information for MBTA species. Birds of Conservation Concern that could occur in the offshore waters of the SCB action area include Layson albatross (*Phoebastria immutabilis*), black-footed albatross (*Phoebastria nigripes*), pink-footed shearwater (*Puffinus creatopus*), Black-vented shearwater (*Puffinus opisthomelas*), ashy storm-petrel (*Oceanodroma homochroa*), gull-billed tern (*Sterna nilotica*), black skimmer (*Rynchops niger*), Guadalupe murrelet (*Synthliboramphus hypoleucus*), Scripps's murrelet (*Synthliboramphus scrippsi*), and Cassin's auklet (*Ptychoramphus aleuticus*).

### 3.3.2.6 Marine Mammals

All marine mammals in the United States are protected under the MMPA, and some species receive additional protection under the ESA. NMFS has jurisdiction over whales, dolphins, porpoises, seals, and sea lions, whereas the USFWS has jurisdiction over certain other marine mammal species, including walruses, polar bears, dugongs, sea otters, and manatees.

There are 34 cetacean species (whales, dolphins, and porpoises), 6 pinniped species (sea lions, fur seals, and true seals), and 1 sea otter species that can be found in the SCB (Navy 2009, 2017b) (Table 3.3-3). Within the cetaceans, "Odontocetes" include toothed whales, dolphins, and porpoises, whereas "Mysticetes" refers to baleen whales. Odontocetes range in size from slightly longer than 3.3 feet to more than 60 feet and have teeth, which they use to capture and consume individual prey. Odontocetes are divided into several families. Mysticetes are universally large whales (more than 15 feet as adults) that use baleen, a fibrous structure made of keratin (a type of protein like that found in human fingernails) instead of teeth, to feed.

**Table 3.3-3 Summary of Marine Mammal Species in Waters off Southern California**

| *Common Name* | *Stock* | *Warm Season (May-Oct)* | *Cold Season (Nov-Apr)* |
|---|---|---|---|
| **ESA-listed Marine Mammals** | | | |
| Blue whale | Eastern North Pacific | Yes | No |
| Fin whale | California, Oregon, and Washington | Yes - More | Yes - Less |
| Humpback whale | California, Oregon, and Washington | Yes | No |
| North Pacific right whale[1] | Eastern North Pacific | Rare | Rare |
| Sei whale | Eastern North Pacific | Unknown | Unknown |
| Sperm whale | California, Oregon, and Washington | Yes | Yes |
| Guadalupe fur seal[1] | Mexico | Yes[2] | Yes[2] |
| Steller sea lion | California, Oregon, and Washington | No | No |
| Southern sea otter[1] | California | Extralimital[2] | Extralimital[2] |
| **Mysticetes (non ESA-listed baleen whales)** | | | |
| Bryde's whale | Eastern Tropical Pacific | Yes | Rare |
| Gray whale | Eastern North Pacific | No | Transient |
| Minke whale | California, Oregon, and Washington | Yes | Yes |
| **Odontocetes (non ESA-listed toothed whales and dolphins)** | | | |
| Baird's beaked whale | California, Oregon, and Washington | Yes | Yes |
| Bottlenose dolphin - coastal stock | California coastal | Yes | Yes |
| Bottlenose dolphin - offshore stock | California offshore | Yes | Yes |
| Cuvier's beaked whale | California, Oregon, and Washington | Yes | Yes |
| Dall's porpoise | California, Oregon, and Washington | No | Yes |
| Dwarf sperm whale | California, Oregon, and Washington | Unknown | Unknown |
| False killer whale | Eastern Tropical Pacific | Unknown | Unknown |
| Killer whale - offshore stock | Eastern North Pacific | No | Yes |
| Killer whale - transient stock | Eastern North Pacific | No | Yes |
| Long-beaked common dolphin | California | Yes | Yes |
| Mesoplodont beaked whales | California, Oregon, and Washington | Unknown | Unknown |
| Northern right whale dolphin | California, Oregon, and Washington | No | Yes |
| Pacific white-sided dolphin | California, Oregon, and Washington | Yes - Less | Yes - More |
| Pantropical spotted dolphin | Eastern Tropical Pacific | Unknown | Unknown |
| Pygmy sperm whale | California, Oregon, and Washington | Unknown | Unknown |
| Risso's dolphin | California, Oregon, and Washington | Yes - Less | Yes - More |
| Rough-toothed dolphin | Tropical and Warm Temperate | Rare | Rare |
| Short-beaked common dolphin | California, Oregon, and Washington | Yes - More | Yes - Less |
| Short-finned pilot whale | California, Oregon, and Washington | Unknown | Unknown |
| Spinner dolphin | Tropical and Warm Temperate | Rare | Rare |
| Striped dolphin | California, Oregon, and Washington | No | Rare |
| **Pinnipeds (non ESA-listed sea lions, fur seals, and true seals)** | | | |
| Pacific harbor seal | California | Yes[2] | Yes[2] |
| Northern elephant seal[1] | California breeding | Yes[2] | Yes[2] |
| California sea lion | U.S. Stock | Yes[2] | Yes[2] |
| Northern fur seal | San Miguel Island | Yes - More[2] | Yes - Less[2] |

*Note:* [1]California Department of Fish and Wildlife Fully Protected Species/Non-game Wildlife Program.
[2]Very unlikely to occur seaward of 12 NM from shore, likely not present in the Phase 1a Study Area.

*Source*: Navy 2017b.

Mysticetes typically engulf, suck, or skim the water into their mouth and then push the water out as large quantities of prey, including small schooling fish, shrimp, and zooplankton (e.g., copepods and krill) are filtered by the baleen (Heithaus and Dill 2008). Detailed reviews of the different groups of cetaceans can be found in Jefferson et al. (2015) and Perrin et al. (2009a). The different feeding strategies of mysticetes and odontocetes affect their distribution and occurrence patterns (Goldbogen et al. 2015).

Pinnipeds in the Study Area are also divided into two groups: phocids (true seals, lacking external ears) and otariids (fur seals and sea lions, with external ear flaps). Pinnipeds spend a large portion of their time in the Study Area on land at haulout sites used for resting and moulting, and at rookeries used for breeding and nursing young. All pinnipeds return to the water to forage. Four species of pinnipeds (California sea lion, Guadalupe fur seal, northern elephant seal, and Pacific harbor seal) occur in the SCB as regular inhabitants.

The southern sea otter (*Enhydra lutris nereis*) is the only species of sea otter present in the SCB. Sea otters rarely come ashore and spend most of their life in shallow water nearshore, especially in kelp beds, where they regularly swim, feed, and rest (Lafferty and Tinker, 2014). A small population was introduced at San Nicolas Island during the 1980s and persists to the present. Sea otters may be encountered, usually close to shore, elsewhere throughout the SCB.

Detailed descriptions of the marine mammal species inhabiting the SCB, including their population sizes, seasonal distributions, diets and feeding habits, sources of mortality, and environmental concerns, are provided by Navy (2017b, 2018a) and Bonnell and Dailey (1993).

### 3.3.3 Environmental Consequences

This analysis focuses on species and resources that are important to the function of the ecosystem or are protected under federal or state law or statute. Under the No Action Alternative, the Proposed Action would not occur and there would be no change to biological resources. Therefore, no significant impacts to marine biological resources would occur with implementation of the No Action Alternative. The remainder of this section describes the potential impacts of the Proposed Action.

The approximate dimensions of each Phase 1a floats are listed in in Table 2-1. Assuming up to 1,000 floats and approximately 333 of each design, the total volume of all Phase 1a floats would be approximately 280 cubic feet (7,927 liters). Their total cross-sectional area when scuttled would be approximately 1,798 square feet (167 square meters). A sub-set of floats would have suspended attachments (Phase 1a floats only suspend ballast) and once scuttled suspended cords are assumed to double the cross-sectional area, adding approximately 133 square feet (12 square meters). The total potential direct footprint of all scuttled Phase 1a floats is approximately 1,931 square feet (179 square meters), about the same square footage as a modest apartment, representing less than one billionth of the Study Area.

The ultimate distribution of scuttled floats cannot be reliably estimated; in any case it would probably not be uniform, and could be somewhat clustered as a result of gyres, mesoscale to submesoscale eddies, and scuttle boundary locations. To examine a range, including worst case, of potential impacts to substrates, two scenarios are examined: (1) **Worst-Case Impacts**, in which each substrate type would receive 100 percent of the floats (Table 3.3-4); and (2) **Proportional Impacts**, in which the area of substrate impacted is in direct proportion to the area of substrate. Even the worst-case would impact a very small percentage of any substrate type (Table 3.3-4).

**Table 3.3-4 Sizes of Study Area Features Relative to Footprints**

| *Features of the proposed Study Area* | *Area (km$^2$) or Perimeter (km)* | *Percent of feature relative to the Study Area (e.g. the EEZ is 6.3% of the Study Area)* | *130 m$^2$ of float coverage relative to the feature [4]* |
|---|---|---|---|
| Size of Study Area | 765,560 km$^2$ | n/a | 23 billionths of 1% |
| Size of US EEZ within Study Area | 48,240 km$^2$ | 6.3% | 372 billionths of 1% |
| Size of continental shelf[1] within Study Area | 1,500 km$^2$ | 0.1959% | 12 millionths of 1% |
| Size of "hard or intermediate seafloor"[2] within Study Area | 120,950 km$^2$ | 15.8% | 148 billionths of 1% |
| Size of "hard or intermediate seafloor"[2] within Study Area US EEZ | 28,040 km$^2$ | 58.1% | 640 billionths of 1% |
| Size of "soft seafloor"[2] within Study Area | 644,610 km$^2$ | 84.2% | 28 billionths of 1% |
| Size of "soft seafloor"[2] within Study Area US EEZ | 20,200 km$^2$ | 41.9% | 888 billionths of 1% |
| Size of Groundfish EFH within Study Area | 28,040 km$^2$ | 3.7% | 640 billionths of 1% |
| Size of Rocky Reef HAPC within the Study Area | 1,000 km$^2$ | 0.1306% | 18 millionths of 1% |
| Perimeter of Study Area (total geofence) | 4,350 km | n/a | 4 thousandths of 1% |
| Study Area perimeter against the 12NM geofence (22.22 km) | 1,659 km | 38.1% | 11 thousandths of 1% |
| Geofence along groundfish EFH | 624 km | 14.3% | 29 thousandths of 1% |
| Smallest distance between Study Area geofence and any kelp[3] | 20 km | n/a | n/a |
| **Maximum footprint of scuttled floats[4]** | **0.000130 km$^2$** | **n/a** | **23 billionths of 1%** |

Notes: All values are approximations that may change by a few percent as different precision standards are used.

[1] Continental Shelf is shallower than 200 meters using BlueHabitat's definition (Harris et al. 2014).

[2] Seabed substrate attributes (hard/intermediate/soft) were applied to the Harris et al (2014) BlueHabitat seafloor classifications by M Lybolt (2 May 2019), supplemented by classifications in International Hydrographic Organization (2008) and Divins (2003).

[3] Kelp mapping as shown on Figure 3-3.

[4] Assumes the scuttled float footprint occurs as 1 m$^2$ units.

The sinking velocity would be relatively low, and the weight of a float would probably be insufficient to have an impact on the substrate other than physically covering it; this would be a temporary effect as the float would subsequently be covered with sediment and/or marine growth, and gradually disintegrate. The floats' programmed scuttling would account for potential drift between the surface and the bottom and provide a sufficient buffer distance outside the scuttle boundary that minimizes the possibility that a float will end up inside the scuttle boundary when it reaches the bottom. Float constituents are not expected to accumulate and measurably affect sediment or water quality (Section 3.4).

#### 3.3.3.1 Alternative 1

**Marine Habitats and Vegetation**

Marine habitats within 12 NM of the shoreline are specifically excluded from the Study Area and floats would be scuttled well before entering these habitats. Most benthic marine vegetation occurs within 12 NM of the shoreline, including all canopy kelp, and the Proposed Action would have no effect on these resources. Interaction between a float and benthic marine vegetation is exceptionally unlikely because measures would be implemented to minimize potential for any floats to travel beyond the Study Area boundary (see Section 2.1.3).

Water column habitat is susceptible to physical contact, artificial lighting, acoustic, water quality, and chemical risks. Floats were carefully designed to eliminate or minimize their potential risks to the environment, and there are no reasonable mechanisms for Phase 1a floats to impact water column habitat. The deployment of the floats, their subsequent drifting, and ultimate scuttling would have only momentary interactions with any particular unit of the ocean surface or water column habitat. Potential risks would be minimized by design and exposures to any risks are discountable because of the extremely low density of floats, occupying 23 billionths of one percent of water column habitat in the Study Area (Table 3.3-4). If floats were well dispersed there would be less than 1 float per 100 square km. Put in a terrestrial perspective, one child's kite has about the same footprint as one float, and the density of floats is equivalent to 10 kites within the City of San Diego. Floats would disperse and coalesce depending on conditions, and as floats coalesce the probability that a "group" of floats would occupy a particular habitat diminishes even further.

Benthic habitat is susceptible to physical contact and chemical risks. Other potential risks are not analyzed (i.e., ingestion, entanglement, artificial lighting, or acoustics) because there is no reasonable mechanism for impact to benthic habitat. Benthic habitat would receive 100 percent of the scuttled floats. The total potential footprint of all scuttled Phase 1a floats is approximately 1,931 square feet (179 square meters). An implausible worst-case estimate would assume that 100 percent of Phase 1a floats scuttle along the 12 NM geofence, which has relatively higher habitat value, affecting approximately 1,931 square feet (179 square meters) of habitat. A reasonably likely proportional footprint to hard substrate habitat (e.g., rocky reef, deep-water coral and sponge) is approximately 304 square feet (28 square meters), because hard substrate habitat occurs in approximately 15.8 percent of the Phase 1a Alternative 1 Study Area (Table 3.3-4). The actual size of the footprint depends on many factors (orientation of the scuttled equipment, condition of the float, the nature of the seafloor, etc.), but none of these meaningfully affect the analyses of the total footprint of all scuttled floats.

Consequences of scuttled floats physically occupying benthic habitat may adversely affect habitat, but would be less than minimal for two main reasons. First, most benthic habitat is not considered sensitive to debris and most impact from physical contact occurs during fishing or construction (PFMC 2016b). Additionally, a scuttled float is unlikely to settle on the seafloor with enough force to damage biogenic habitat (e.g., sponge, coral, worms, bivalves). Second, the magnitude of physically contacting and obstructing approximately 1,931 square feet (179 square meters) of native seafloor materials may adversely affect habitat, but would be too small for any meaningful consequence to the quantity or quality of benthic habitat. The total footprint of Phase 1a floats amounts to 23 billionths of one percent of benthic habitat in the Study Area. Scuttled floats could provide attractive refuge for small organisms

(Watters et al. 2010; Smith and Mark 2016; Navy 2018a), but for the same reasons, any potential benefit would be too small for any meaningful consequence.

Consequences of physical- chemical- and bio-degradation of scuttled floats would be short-term to long-term and less than minimal, mainly because the floats are designed to exert near-zero physical and chemical risks during degradation. In the context of deep ocean floor habitat, the duration of short-term effects would span months to years; long-term effects would span decades; and permanent effects would be greater than 100 years. These are discussed under Section 3.4, *Sediments and Water Quality*.

The extent, magnitude, and duration of effects to benthic habitat from scuttled floats would diminish over time. Floats are designed with a minimum of non-degradable components (Table 2-1) and these would have essentially permanent seafloor effects. The total footprint of permanent effects of Phase 1a floats would be approximately 1,931 square feet (179 square meters). Most float components that contain plastic are sufficiently dense to remain on the seafloor during degradation. Some small pieces of plastic may float, and these would likely persist in the marine environment with the same trajectory as other as floating debris. Consequences of non-degradable components would be limited to physical contact because non-degradable components are essentially inert.

Vegetation is somewhat susceptible to physical contact. Other potential risks are not analyzed (i.e., ingestion, entanglement, artificial lighting, or acoustics, chemical) because there is no reasonable mechanism for impact to marine vegetation. Physical contact between floats and paddies of drifting kelp would be very rare because both would tend to drift the same direction, and because both are exceptionally low-density. Given a maximum density of 7 paddies per square km, with an average size of 10 square meters (Hobday 2000), kelp paddies would occupy less than 0.01 percent of the Study Area. Assuming that floats and paddies move in directions that promote “collisions,” fewer than 1 out of 10,000 floats would contact a kelp paddy. Consequences of physical contact would be discountable because the floats are too small to meaningfully affect photosynthesis, are designed without features that could cut or entangle the kelp, and would simply sink through the kelp paddy when scuttled. In the improbable scenario that a suspended attachment becomes entangled with the paddy, the scuttling float could pull part or all of the kelp paddy to the bottom, resulting in a loss of surface kelp. The combined low probabilities of contact, of entanglement, and trivial consequence of a kelp paddy sinking prematurely would be inconsequential and unmeasurable to marine vegetation.

The overall potential consequence to marine habitats and vegetation would vary, regardless of the final distribution of scuttled floats. Floats and components are expected to be very widely dispersed, but could become somewhat concentrated in the unlikely scenario that strong winds or currents drive many floats into one section of geofence. Scuttled floats and their components may be considered similar to other types of marine debris in terms of potential effects, including fishing gear, waste from boaters and urban runoff, and the materials expended in Navy training on military ranges. Studies of such debris and its effects have found, with the exception of fishing nets, traps, and monofilament line (none of which are similar to floats or float components), little evidence of harmful effects, and no long-term changes, to populations, communities, or habitats on the bottom (Watters et al. 2010; Smith and Mark 2016; Navy 2018a).

Overall, float scuttling is expected to have minor short-term to long-term effects to marine habitats and essentially zero effects to vegetation. Scuttled floats may adversely affect habitat, but effects would be too small for any meaningful consequence to the quantity or quality of benthic habitat. As a result, Alternative 1 would not have a significant impact on marine habitats and vegetation within the U.S. Territorial Sea, or result in significant harm to these resources on the global commons.

**Invertebrates**

As noted above, scuttled floats would contact 23 billionths of one percent of the benthic habitat for invertebrates off of southern California and Baja California (Table 3.3-4). A scuttled float is unlikely to land with enough force to damage most types of invertebrates on the bottom, with the possible exception of relatively delicate sessile invertebrates (e.g., glass sponges). The most likely consequence of any physical contact would be temporary disturbance, a less likely consequence could be reduced reproductive output during regrowth, and a much less likely consequence could be mortality for organisms completely covered by the scuttled float. The magnitude of scuttled floats physically contacting and obstructing approximately 1,931 square feet (179 square meters) of native seafloor is too small for any meaningful consequence to marine invertebrates. The total footprint of Phase 1a floats amounts to less than one billionth of benthic habitat in the Study Area. Scuttled floats could provide attractive refuge for small organisms (Watters et al. 2010; Smith and Mark 2016; Navy 2018a), but for the same reasons, any potential benefit would be too small for any meaningful consequence.

EFH for marine invertebrates are discussed separately in an *Essential Fish Habitat Assessment*. In summary, potential impacts to water column EFH are discountable because there are no reasonable mechanisms for Phase 1a floats to impact water column habitat, because the magnitude of potential risks is less than minimal by design, and because the extremely low density of floats minimizes exposure to any particular unit of water column habitat. Potential impacts to benthic EFH are discountable for the same reasons discussed under Marine Habitats (above). There are no reasonable mechanisms for Phase 1a floats to impact managed marine invertebrate fisheries in the Study Area (e.g., krill).

ESA-listed marine invertebrate species may interact with the floats only if they scuttle on the shallowest portions of Tanner and Cortez banks (depths of 20-60 m), and this scenario is exceptionally unlikely because of the extremely low density of floats, the small size of Tanner and Cortez banks relative to the Study Area, and the lack of a geofence boundary in the area. Because there are no reasonable mechanisms for Phase 1a floats to differentially affect white abalone, and because potential interaction is exceptionally unlikely, potential negative effects are discountable. Potential effects to black abalone or their habitats are exceptionally unlikely because measures would be implemented to minimize potential for any floats to travel beyond the Study Area boundary. Alternative 1 may affect but is not likely to adversely affect ESA-listed marine invertebrate species. This conclusion requires informal ESA section 7 consultation with, and concurrence from NMFS (refer to Appendix A).

Based on the foregoing, Alternative 1 would not have a significant impact on invertebrates within the U.S. territorial sea, or result in significant harm to these resources on the global commons.

**Fishes**

The deployment of the floats, their subsequent drifting, and ultimate scuttling would have only momentary interactions with any particular fish or unit of water column fish habitat. Disturbance and vessel noise (which would be low due to the slow speed of the vessel [approximately 8 knots]) during float deployment may elicit a minor temporary behavioral response from fish such as swimming away from the vessel, but would have no other effects on individual fish. The areas of deployment would represent a tiny fraction of the ocean surface, only momentarily disturbed, with no potential to affect fish populations. Disturbance associated with drifting floats may elicit a temporary behavioral response from fish that are within sight-distance of the float, such as avoidance or attraction to the floating object, and no other effects are plausible. Consequences of attraction could include increased susceptibility to predation and increased feeding efficiency for predators. Demersal fish would have elevated exposures to floats because benthic fish habitat would receive 100 percent of the scuttled floats. The total footprint of scuttled Phase 1a floats affecting approximately 1,931 square feet (179 square meters) of benthic fish habitat would be too small for any meaningful consequence to fish or fish habitat. The total footprint of Phase 1a floats amounts to 23 billionths of one percent of benthic habitat in the Study Area. Scuttled floats could provide attractive refuge for small organisms (Watters et al. 2010; Smith and Mark 2016; Navy 2018a), but for the same reasons, any potential benefit would be too small for any meaningful consequence.

Fish entanglement in a suspended line is practically impossible because these structures would be highly visible, slowly drifting with the current, and without loose ends or loops that could entangle a fish. Ingestion by fishes is considered similarly implausible because the floats do not resemble food in size or texture. Additionally, bottom-feeding organisms are adept at rejecting or processing non-food items without injury (e.g., rocks, shells, skeletons).

EFH is discussed in a separate consultation submitted to NMFS (refer to Appendix A). In summary, potential impacts to water column EFH are discountable because there are no reasonable mechanisms for Phase 1a floats to impact water column habitat, because the magnitude of potential risks is less than minimal by design, and because the extremely low density of floats minimizes exposure to any particular unit of water column habitat. Potential impacts to benthic EFH are less than minimal for the same reasons discussed under *Marine Habitats and Vegetation* (above). There are no reasonable mechanisms for Phase 1a floats to differentially affect managed fish species, and any impacts would be too small for any meaningful consequence for the same reasons discussed for fish (above). In accordance with the MSA, the Navy has prepared an *Essential Fish Habitat Assessment* and submitted it separately to NMFS with a request for consultation. The Navy will consider NMFS EFH conservation recommendations on the Proposed Action.

ESA-listed fish may interact with the floats, but there are no reasonable mechanisms for Phase 1a floats to differentially affect ESA-listed fish species. Therefore any impacts to ESA-listed fish species would be discountable for the same reasons discussed for non-listed fish (above). The Proposed Action may affect but is not likely to adversely affect ESA-listed fish species. This conclusion requires informal ESA section 7 consultation with, and concurrence from NMFS (refer to Appendix A).

Based on the foregoing, the Proposed Action would not have a significant impact on fishes within the U.S. Territorial Sea, or result in significant harm to these resources on the global commons.

**Sea Turtles**

Sea turtle presence in the action area is likely to consist of very low densities with individuals in transit or foraging on the open ocean for floating plants and debris. Although juvenile loggerhead turtle densities may be higher in late summer (July-September), all major in-water threats are related to drowning in fishing gear (Fisheries and Oceans Canada 2016; Ellis 2016). Fishing gear is optimally designed to lethally entangle, entrap, or hook marine organisms, and because there are no common elements between fishing gear and the floats' design, there is no potential for similar lethal interactions. During float deployment, the visual presence and noise associated with the M/V Diane G or a similar vessel may elicit avoidance behavior (diving or swimming). This would be a brief response, the energetic consequences of which would be negligible because the animal could resume activity after moving either a short distance away or within the same area a short time later after the vessel moves on.

The potential for the M/V Diane G or a similar vessel to strike a sea turtle would be avoided by following Navy Standard Operating Procedures. Civilian and military personnel engaged in float deployment will have taken the Navy's Marine Species Awareness Training and will be familiar with the identification of, and legal protections that apply to, the marine mammals and sea turtles that occur in the SCB. Personnel would be alert to any circumstance where a marine mammal or sea turtle would be at risk of harm, and will notify the ship's operators as appropriate so that precautionary measures can be taken, including maneuvering to avoid sighted sea turtles.

The only reasonably likely potential interaction with sea turtles is the extremely low-likelihood possibility of temporarily interrupting feeding while encountering a float and avoiding or rejecting it. Sea turtles would have a low likelihood of encountering a float because of the extremely low density of floats. If floats were well dispersed through the Study Area, maximizing probability that an individual animal would encounter a float, there would be less than 1 float per 100 square km. Floats will disperse and coalesce depending on conditions, and as floats coalesce the probability that an individual animal would encounter a float diminishes even further. Potential ingestion-related consequences are discountable because the floats are too large and rigid for pelagic-feeding turtles to bite, and bottom-feeding turtles are adept at rejecting or processing non-food items without injury (e.g., rocks, shells, skeletons). Pelagic-feeding turtles ingest only soft-bodied prey (e.g., jellyfish), and debris they ingest is generally soft plastic. The possibility of sea turtle entanglement in a suspended line is practically impossible because no aspect of the floats are designed to entangle, entrap, or hook marine organisms, and because the weight at the end of the line would keep it from forming loops.

ESA-listed turtles may interact with the floats, but the analysis indicates a discountable or very low possibility of negative effect, therefore the conclusion is that Alternative 1 may affect but is unlikely to adversely affect sea turtles; this conclusion requires informal ESA section 7 consultation with, and concurrence from NMFS (refer to Appendix A). Pending the completion of consultation, Alternative 1 would not have a significant impact on sea turtles within the U.S. Territorial Sea, or result in significant harm to these resources on the global commons.

**Seabirds**

During float deployment, the visual presence and noise associated with the M/V Diane G or a similar vessel may elicit avoidance behavior (diving or swimming). This would be a brief response, the energetic consequences of which would be negligible because the animal could resume activity (feeding or resting on the water) after moving either a short distance away or within the same area a short time later after the vessel moves on.

It may be possible for seabirds to land and rest on the floats. However, the potential for ingestion by seabirds is discountable. A diving seabird may approach a suspended line during feeding behaviors but there is no reasonable mechanism for the animal to be harmed. Although diving seabirds are often killed by ingesting fishing gear, there is no potential for similar lethal interactions with floats because they have no similar elements as fishing gear that is optimally designed to lethally entangle, entrap, or hook marine organisms. No other interactions between seabirds and the floats are anticipated. As a result, Alternative 1 would not have a significant impact on seabirds within the U.S. Territorial Sea, or result in significant harm to these resources on the global commons. Likewise Alternative 1 would not result in a significant adverse effect on a population of a migratory bird species.

**Marine Mammals**

During float deployment, the visual presence and noise associated with the M/V Diane G or a similar vessel may elicit avoidance behavior (diving or swimming). This would be a brief response, the energetic consequences of which would be negligible because the animal could resume activity after moving either a short distance away or within the same area a short time later after the vessel moves on.

The potential for the M/V Diane G or a similar vessel to strike a marine mammal would be avoided by following Navy Standard Operating Procedures and mitigation measures as follows. Civilian and military personnel engaged in float deployment will have taken the Navy's Marine Species Awareness Training and will be familiar with the identification of, and legal protections that apply to, the marine mammals and sea turtles that occur in the SCB. Personnel will be alerted to any circumstance where a marine mammal or sea turtle would be at risk of harm, and will notify the ship's operators as appropriate so that precautionary measures can be taken. In particular, the Navy's Protective Measures Assessment Protocol for marine mammals would be followed: a lookout would be present at all times while the vessel is underway, and "mitigation zones" would be observed, wherein the vessel would maneuver to maintain a distance greater than 500 yards of a whale or 200 yards of other marine mammals, with the exception of bow-riding dolphins or pinnipeds hauled out on a manmade structure.

In addition, the Navy implements mitigation areas to avoid potential impacts on marine mammals. The Navy observes an Awareness Notification Message Area in at-sea areas off southern California for blue whales (June – October), gray whales (November – March), and fin whales (November – May). The Navy issues seasonal awareness notification messages to alert ships and aircraft operating in the area to the possible presence of concentrations of these large whales. To maintain safety of navigation and to avoid interactions with large whales during transits, the Navy instructs vessels to remain vigilant to the presence of large whale species, that when concentrated seasonally, may become vulnerable to vessel strikes. Platforms use the information from the awareness notification messages to assist their visual observation of applicable mitigation zones during training and testing activities and to aid in the implementation of procedural mitigation

The potential for marine mammals to encounter a float is unlikely because of the extremely low density of floats. If floats were well dispersed through the Study Area, maximizing probability that an individual animal would encounter a float, there would be less than 1 float per 100 square km. Put in a terrestrial perspective, one child's kite has about the same footprint as one float, and the density of floats is equivalent to 10 kites within the City of San Diego. Floats will disperse and coalesce depending on conditions, and as floats coalesce the probability that an individual animal would encounter a float diminishes even further. The potential for bottom-feeding marine mammals to encounter scuttled floats on the seafloor would be even lower because the majority of floats would be scuttled in water that is far deeper than the foraging area for bottom-feeding marine mammals (e.g., gray whale and humpback whale) (Hain et al. 1995; Ware et al. 2014).

Given the low likelihood for marine mammals to encounter a float, the potential for ingestion impact to marine mammals is discountable because the floats are orders of magnitude larger than baleen whales' typical prey, are several times larger than the largest debris items known to be ingested by whales, and because bottom-feeding organisms are adept at rejecting or processing non-food items without injury (Laist 1997; Bergmann et al. 2015; Williams et al. 2011). Based on feeding behavior studies and the relative dearth of documented large debris ingestion, marine mammals clearly have the capacity to avoid a float prior to ingestion (Andrady 2011; Whitehead 2003; Williams et al. 2011). The sole remaining potential interaction with marine mammals is the extremely low-likelihood possibility of temporarily interrupting feeding while encountering a float and avoiding or rejecting it. Marine mammals would have a low likelihood of encountering a float, discountable ingestion-related consequences, and low-magnitude consequence of temporarily interrupting feeding.

It is extremely unlikely that a marine mammal would become entangled in a line suspended from the floats for three reasons. First is the low likelihood for marine mammals to encounter a float, discussed above. Second, no aspect of the floats are designed to entangle, entrap, or hook marine mammals. Third, there are no reports of a marine mammal becoming entangled in scientific instrumentation despite large quantities in use (e.g., one portion of one NOAA program deployed 20 km of XBT wire since 2016 [expendable bathythermograph]). Marine mammals would have a low likelihood of encountering a float and an extremely low likelihood of entanglement. As a result, Alternative 1 is very unlikely to affect marine mammals or to result in “take” under the MMPA.

ESA-listed marine mammal species may come into contact with the floats, but there are no reasonable mechanisms for Phase 1a floats to differentially affect ESA-listed marine mammal species. Therefore any impacts to ESA-listed marine mammal species would be discountable for the same reasons discussed for other marine mammals (above). Alternative 1 may affect but is not likely to adversely affect ESA-listed marine mammal species. Therefore, informal section 7 consultation with NMFS for ESA-listed species is required (refer to Appendix A). Pending NMFS concurrence, Alternative 1 would not have a significant impact on marine mammals within the U.S. Territorial Sea, or result in significant harm to these resources on the global commons.

#### 3.3.3.2 Alternative 2

Consequences to marine biological resources under Phase 1a Alternative 2 would be almost identical to consequences under Alternative 1, but at a lesser magnitude because the Alternative 2 Study Area essentially avoids the continental shelf where most marine systems are more biologically productive. Therefore, implementation of Alternative 2 would not result in significant impacts to marine biological resources, or result in significant harm to these resources on the global commons.

## 3.4 Sediments and Water Quality

Marine sediments are the solid fragments of organic and inorganic matter created from weathering rock transported by water, wind, and ice (glaciers) and deposited at the bottom of bodies of water. Components of sediment range in size from boulders, cobble, and gravel to sand (particles 0.05 to 2.0 millimeters [mm] in diameter), silt (0.002 to 0.05 mm), and clay (less than or equal to 0.002 mm). Sediment deposited on the continental shelf is delivered mostly by rivers but also by local and regional currents and wind. Most sediment in nearshore areas and on the continental shelf is comprised of silicate minerals derived from rocks on land that is deposited at rates of greater than ten centimeters per 1,000 years. Sediment may also be produced locally as nonliving particulate organic material (“detritus”) that travels to the bottom. Some areas of the deep ocean contain an accumulation of the shells of marine organisms composed of silicon and calcium carbonate, termed biogenic ooze. Through the downward movement of organic and inorganic particles in the water column, substances that are otherwise scarce in the water column (e.g., metals) are concentrated in bottom sediment.

Marine waters would typically include estuaries, waters seaward of the historic height of tidal influence, and offshore high salinity waters. Marine water quality would be described as the chemical and physical composition of the water as affected by natural conditions and human activities. Additionally, marine waters may include an area within a National Marine Sanctuary requiring an action proponent to avoid adverse water quality impacts in order to prevent damage to resources within the sanctuary.

### 3.4.1 Regulatory Setting

State jurisdiction regarding sediments and water quality extends from the low tide line to 3 NM offshore for California. Creating state-level sediments and water quality standards and guidelines begins with each state establishing a use for the water, which is referred to as its "designated" use. Examples of such uses of marine waters include fishing, shellfish harvesting, and recreation. For this section, a water body is considered "impaired" if any one of its designated uses is not met. Once this use is designated, standards or guidelines are established to protect the water at the desired level of quality.

Federal jurisdiction regarding sediments and water quality extends from 3 to 200 NM along the Pacific coast of the United States. These standards and guidelines are mainly the responsibility of the U.S. Environmental Protection Agency (USEPA), specifically ocean discharge provisions of the CWA (33 U.S.C. Section 1343). Ocean discharges may not result in "unreasonable degradation of the marine environment." Specifically, disposal may not result in: (1) unacceptable negative effects on human health; (2) unacceptable negative effects on the marine ecosystem; (3) unacceptable negative persistent or permanent effects due to the particular volumes or concentrations of the dumped materials; and (4) unacceptable negative effects on the ocean for other uses as a result of direct environmental impact (40 CFR Section 125.122).

Floats could drift beyond 200 NM. Even though CWA regulations may not apply to these areas, pertinent water quality standards are used as accepted scientific standards to assess potential impacts on sediments and water quality from the Proposed Action.

The National Defense Authorization Act of 1996 amended Section 312 of the CWA, directing the USEPA and the Department of Defense to jointly establish the Uniform National Discharge Standards for discharges (other than sewage) incidental to the normal operation of military vessels. The Uniform National Discharge Standards program establishes national discharge standards for military vessels in U.S. coastal and inland waters extending seaward to 12 NM. Twenty-five types of discharges were identified as requiring some form of pollution control (e.g., a device or policy) to reduce or eliminate the potential for impacts. The discharges addressed in the program include, ballast water, deck runoff, and seawater used for cooling equipment. For a complete list of discharges, refer to 40 CFR part 1700.4.

These national discharge standards reduce the environmental impacts associated with vessel discharges, stimulate the development of improved pollution control devices aboard vessels, and advance the development of environmentally sound military vessels. The U.S. Navy adheres to regulations outlined in the Uniform National Discharge Standards program and the Ocean Dumping Act, and, as such, the analysis of impacts in this EA/OEA will be limited to potential impacts from the deployment and subsequent scuttling of the floats.

Marine debris is governed internationally by the 1972 London Convention and 1996 London Protocol and regulated in the U.S. through the Marine Debris Act and the Marine Dumping Act.

### 3.4.2 Affected Environment

The following discussions provide a description of the existing conditions for marine sediments and water quality in the Study Area. The Study Area includes the Pacific Ocean off southern California and

Baja California, generally south of the Channel Islands and extending offshore in the Pacific Ocean (Figure 2-1)

#### 3.4.2.1 Sediments

The composition and distribution of bottom substrates in the California Current Large Marine Ecosystem are discussed in Section 3.3.2, *Marine Biological Resources*. In the National Coastal Condition Report IV (USEPA 2012), estuarine and coastal ocean areas in the USEPA's West Coast Region, which extends along the entire U.S. West coast, were rated as good, fair, or poor for sediment contaminants, toxicity, and total organic carbon. Overall, sediment quality was rated fair. For sediment contaminants, the USEPA rated 96 percent of coastal ocean sediments as good, 3 percent as fair and less than 1 percent as poor. Contaminant levels in coastal ocean and estuarine waters within the Study Area were rated as good (USEPA 2012).

Higher levels of total organic carbon in sediments can be an indicator of higher concentrations of chemical pollutants and poor sediment quality (USEPA 2012). Within the West Coast Region, only two sites, both in the Channel Islands, received a poor rating for total organic carbon. Although these sites are located adjacent to the Study Area neither fall within the Study Area boundaries.

In a report on the SCB 2013 Regional Monitoring Program, the Southern California Coastal Water Research Project found that 68 percent of sediments in the SCB have minimal or low contamination, and less than 1 percent have high contamination, the worst category (Dodder et al. 2016). The Study Area overlaps with approximately the southern third of the SCB, from south of San Clemente Island to the U.S. Mexico border. Higher levels of sediment contamination occurred generally in nearshore embayments rather than in offshore sediments on the continental shelf and slope, and the distribution of contaminants was dependent on the location of the source of the contaminant. For example, concentrations of dichlorodiphenyltrichloroethane are higher in sediments off Los Angeles due to long-term discharges from the Los Angeles sanitation district ocean outfall, whereas, copper concentrations are higher in sediments in San Diego Bay, which is home to several large marinas, due to the use of anti-fouling paints on recreational and commercial vessels (Dodder et al. 2016; Neira et al. 2009).

Overall, trends for the entire SCB have been stable since 2003, but the sediment condition for some habitats within the SCB has changed. For example, the spatial extent of sediments with acceptable chemistry in ports, bays, and marinas steadily improved from 40 percent in 1998 to 72 percent in 2013. However, the extent of acceptable sediment chemistry in continental shelf sediments declined from 93 percent in 1998 to 80 percent in 2013, suggesting a possible decline in offshore benthic habitat. The concentrations of some contaminants of emerging concern, such as polybrominated diphenyl ether flame retardants have been reduced, likely due to the implementation of regulations that restrict the production and use of these chemicals beginning in 2010 (Dodder et al. 2016). Between 2008 and 2013, Dodder et al. (2016) reported a 10-fold reduction in the average concentration of polybrominated diphenyl ether flame retardants in embayments.

In 2013, for the first time, the Southern California Coastal Water Research Project surveyed sediments in offshore submarine canyons and marine protected areas (Dodder et al. 2016). As suspected, the concentration of sediment contaminants was higher in canyons and marine protected areas that were adjacent to continental shelf areas with higher levels of contaminants, indicating that contaminated sediments on the shelf are being transported into adjacent canyons and marine protected areas.

The Southern California Bight 2013 Regional Monitoring Program conducted a comprehensive regional assessment of trash and marine debris in streams and nearshore waters of the SCB (Moore et al. 2016). While macro-marine debris (debris greater than 5 mm in diameter) found on the seafloor have been quantified in past studies of the SCB, Moore et al. (2016) sampled, for the first time, micro-marine debris (particles 5 mm or less in diameter) imbedded in seafloor sediments. The study analyzed 164 benthic trawl samples and found that one-third of the seafloor in the SCB contained anthropogenic macro-debris with plastics being the most widespread type of debris. Debris consisted of plastic, cans, glass bottles, metal, lumber, and other debris (e.g., cloth, tape, fiberglass, and caulk). The extent of seafloor macro-debris nearly doubled from 1994 to 2013, and the extent of plastic debris increased threefold. Plastic macro-debris was found throughout the SCB. The extent and abundance of micro-debris (less than 5 mm in diameter) in the SCB was assessed by collecting 358 sediment samples across 12 different habitats in the SCN. Benthic micro-plastic debris were found in 38 percent of sediments (Moore et al. 2016). Embayments were the habitat with the greatest relative extent and abundance of micro-plastic debris, with the vast majority of the seafloor in ports, marinas, and bays containing micro-plastic debris. Continental shelf habitats had the lowest extent and abundance of benthic micro-plastic. Nylon and high-density polyethylene were the most common polymer types.

Watters et al. (2010) conducted a visual survey of the seafloor that included a portion of the Navy's Southern California Range Complex as part of a 15-year quantitative assessment of marine debris on the seafloor off the California coast. Watters et al. (2010) found that plastics, including recreational monofilament fishing line, were the most abundant material and dominated the debris encountered on the seafloor. The visual survey of the seafloor by Watters et al. (2010) encountered only a single object that was potentially "military" in origin (it appeared to be a shell casing). Navy vessels have a zero-plastic discharge policy and return all plastic waste to appropriate disposal or recycling sites on shore.

#### 3.4.2.2 Water Quality

The current state of water quality in the Study Area, from nearshore areas to the open ocean and deep sea bottom, is discussed below. Table 3.4-1 provides the water quality criteria and index for the U.S. West Coast.

The SCB is influenced by two major oceanic currents: the southward flowing, cold-water California Current and the northward flowing, warm-water California Countercurrent. These currents mix in the SCB and strongly influence patterns of ocean water circulation and temperatures along the southern California coast and the Channel Islands. When the cold California Current reaches Point Conception, the direction of flow carries it away from the shoreline that creates a large gyre, or eddy, in the SCB. The return flow of this gyre, the Southern California Countercurrent, moves waters from southeast to northwest through the southern Channel Islands toward the mainland.

The resulting gyres and eddies affect the distribution of marine fauna and flora leading to the presence of both cold and warm temperature species, which thrive in the transition zone and overlap in their distributions. An upwelling current (where nutrient-rich deep waters are drawn to the surface by offshore winds) in the SCB occurs from February or March through August. High nutrient levels combined with increasing day length and light intensity produce exceptionally high phytoplankton and algae production. This increase in food supply supports large numbers of fish, shellfish, and other marine life. Current patterns are predominantly parallel to the shoreline, and typical current speeds are 2 cm per second and 4 cm per second during spring and summer, respectively (Richter 2004).

**Table 3.4-1 Water Quality Criteria and Index, United States West Coast**

<table>
<tr><th rowspan="2">Criterion</th><th colspan="3">Site Criteria</th><th colspan="3">Regional Criteria</th></tr>
<tr><th>Good</th><th>Fair</th><th>Poor</th><th>Good</th><th>Fair</th><th>Poor</th></tr>
<tr><td>Dissolved Inorganic Nitrogen</td><td>< 0.5 mg/L</td><td>0.5–1.0 mg/L</td><td>> 1.0 mg/L</td><td rowspan="3">Less than 10% of the coastal area is in poor condition, and more than 50% of the coastal area is in good condition</td><td rowspan="3">10–25% of the coastal area is in poor condition, or more than 50% of the coastal area is in combined poor and fair condition</td><td rowspan="3">More than 25% of the coastal area is in poor condition</td></tr>
<tr><td>Dissolved Inorganic Phosphorus</td><td>< 0.01 mg/L</td><td>0.01–0.1 mg/L</td><td>> 0.1 mg/L</td></tr>
<tr><td>Water Clarity</td><td>Sites with naturally high turbidity:<br>> 10% light at 1 m<br>Sites with normal turbidity:<br>> 20% light at 1 m<br><br>Sites that support submerged aquatic vegetation:<br>> 40% light at 1 m</td><td>Sites with naturally high turbidity:<br>5–10% light at 1 m<br>Sites with normal turbidity:<br>10–20% light at 1 m<br><br>Sites that support submerged aquatic vegetation: 20–40% light at 1 m</td><td>Sites with naturally high turbidity:<br>< 5% light at 1 m<br>Sites with normal turbidity:<br>< 10% light at 1 m<br><br>Sites that support submerged aquatic vegetation:<br>< 20% light at 1 m</td></tr>
<tr><td>Dissolved Oxygen</td><td>> 5.0 mg/L</td><td>2.0-5.0 mg/L</td><td>< 2.0 mg/L</td><td>Less than 5% of the coastal area is in poor condition and more than 50% of the coastal area is in good condition</td><td>5–15% of the coastal area is in poor condition, or more than 50% of the coastal area is in combined poor and fair condition</td><td>More than 15% of the coastal area is in poor condition</td></tr>
<tr><td>Chlorophyll-a</td><td>< 5 µg/L</td><td>5–20 µg/L</td><td>> 20 µg/L</td><td rowspan="2">Less than 10% of the coastal area is in poor condition, and more than 50% of the coastal area is in good condition</td><td rowspan="2">10–20% of the coastal area is in poor condition, or more than 50% of the coastal area is in combined poor and fair condition</td><td rowspan="2">More than 20% of the coastal area is in poor condition</td></tr>
<tr><td>Water Quality Index</td><td>A maximum of one indicator is rated fair, and no indicators are rated poor</td><td>One of the indicators is rated poor, or two or more indicators are rated fair</td><td>Two or more of the five indicators are rated poor</td></tr>
</table>

*Legend*: < = less than, > = greater than, m = meter, mg/L = milligram per liter, µg/L = microgram per liter.
*Source*: USEPA 2015.

The offshore waters of the Study Area includes areas beyond the U.S. EEZ (i.e., the "high seas"). Small- and large-scale oceanographic processes, including coastal upwelling and advection by offshore currents, result in broad vertical mixing throughout the upper water column and horizontal transport of water from nearshore to offshore areas, which maintain generally high water quality levels that meet or exceed criteria set forth by the California Ocean Plan (State of California 2009) and by the National Ambient Water Quality Criteria (USEPA 2015). The water quality index for the coastal waters of the Study Area is rated good (USEPA 2012).

Water quality inshore of the Study Area is strongly affected by human activities in heavily developed southern California. Urban runoff is the largest source of contaminants along the southern California coast, and can transport bacteria, inorganic nutrients, various organic compounds, metals, and debris into downstream or adjacent water bodies. Nonpoint source runoff is substantial in southern California, because most rivers are highly modified stormwater conveyance systems that are not connected to sewage treatment systems. When storm events occur, runoff plumes can become large oceanographic features that extend for many miles, occasionally entering the Study Area (Center for Ocean Solutions 2009). Along the southern California coast, land-based chemical pollution, in particular polychlorinated biphenyls and dichlorodiphenyltrichloroethane, affect water quality.

Most of the marine water pollution inshore of the Study Area results from municipal discharges. However, this pollution can reach the study area via mixing and ocean currents. Commercial, recreational, and institutional vessels discharge water pollutants when transiting the Study Area. Shipboard waste-handling procedures governing the discharge of nonhazardous waste streams have been established for commercial and Navy vessels. These categories of wastes include (1) liquids: “black water” (sewage); “grey water” (water from deck drains, showers, dishwashers, laundries, etc.); and oily wastes (oil-water mixtures) and (2) solids (garbage).

Marine debris is another source of marine water pollution in the Study Area. The National Marine Debris Monitoring Program developed three categories of marine debris for its study of the extent of manmade materials in the oceans: land-based, ocean-based, and general (i.e., origin unspecified) (Sheavly 2007). Land-based debris may blow in on the wind, be washed in with storm water, arise from recreational use of coastal areas, and be generated by extreme events such as tsunamis. Ocean-based sources of marine debris include commercial shipping and fishing, private boating, offshore mining and extraction, and legal and illegal dumping at sea. Ocean current patterns, weather and tides, and proximity to urban centers, industrial, and recreational areas; shipping lanes; and fishing grounds influence the types and amount of debris found (Sheavly 2010). These materials are found at the near-surface and in the water column.

According to Sheavly (2010), land-based sources account for about half of marine debris and ocean/waterway-based sources contribute another 18 percent, with the remaining sources of unspecified origin. Others have estimated that approximately 80 percent of marine debris originates onshore and 20 percent from offshore sources (Derraik 2002; Hardesty and Wilcox 2017). Bergmuller et al. (2007) also concluded that the majority of marine debris originates from land. Land-based debris included items like syringes, condoms, metal beverage cans, motor oil containers, balloons, six-pack rings, straws, tampon applicators, and cotton swabs. Ocean-based debris included gloves, plastic sheets, light bulbs and tubes, oil and gas containers, pipe-thread protectors, nets, traps and pots, fishing line, light sticks, rope, salt bags, fish baskets, cruise line logo items, and floats and buoys. Plastics make up the vast majority of marine debris (Bergmuller et al. 2007; Law and Thompson 2014).

Marine debris has been discovered to be accumulating in five different gyres throughout the oceans, with two major accumulation zones existing in the Pacific Ocean. Anthropogenic marine debris is also widespread along the U.S. West Coast (Washington to southern California). Military expended materials (ammunition boxes, helmets, rocket boosters and launchers, etc.) were the highest contributors to recovered metals in deeper waters off California in areas known for Navy activities and military dump sites, including around Catalina and San Clemente Islands (Keller et al. 2010).

Plastics may serve as vehicles for transport of various pollutants, whether by binding them from seawater or from the constituents of the plastics themselves. The long-term effects on the environment from the proliferation of microbeads and other micro plastics are still being researched. Studies reviewed by Cole et al. (2011) found that consumption of micro plastics occurred in a range of marine biota, however it remains unclear whether micro plastic ingestion alone will result in adverse health effects (e.g. mortality, morbidity, and reproductive success) or whether such a contaminant can routinely be passed up the food chain. The transfer of toxic chemicals to biota via micro plastic ingestion is a significant concern, yet few existing studies have conducted toxicity-studies using micro plastic vectors (Cole et al. 2011).

Because there is no way of effectively removing micro plastics from the marine environment, and given that plastics are highly resistant to degradation, it is likely that the quantity of micro plastics in the marine environment will only continue to increase, and therefore the likelihood of environmental impacts can only increase (Napper et al. 2015). The only way to reduce long-term impacts is to reduce or eliminate the use of micro plastics, a course of action that is gaining recognition (Chang 2015). Because of their buoyancy, many types of plastic items float and may travel thousands of miles in the ocean (U.S. Commission on Ocean Policy 2004).

### 3.4.3 Environmental Consequences

This analysis looks at the potential impacts on marine sediments and water quality. The analysis of marine sediments considers the depositing of materials on the ocean bottom and any subsequent interactions with sediments or the accumulation of such materials over time. The analysis of water quality considers the potential changes to physical and chemical characteristics of marine waters that may change the water quality, including both improvements and degradation of current water quality.

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline marine sediment and water quality. Therefore, no significant impacts to marine sediment and water quality would occur with implementation of the No Action Alternative. The remainder of this section describes the potential impacts of the Proposed Action.

#### 3.4.3.1 Alternative 1

The exterior of the floats would be made of corrosion resistant materials (e.g., wood, aluminum, solar panels), so release of pollutants during the operational phases of the floats would be minimal or would not occur. The floats would be sealed and have no ballast water system so would not transport any water containing microfauna or biota. Once the floats are scuttled, they would sink to the seafloor and the outer case along with internal materials would be exposed to seawater. In general, three things happen to materials that come to rest on the ocean floor: (1) they lodge in sediments where there is little or no oxygen below 4 inches, (2) they remain on the ocean floor and begin to react with seawater, or (3) they remain on the ocean floor and become encrusted by marine organisms. As a result, rates of deterioration depend on the material and the conditions in the immediate marine and benthic environment. If buried deep in ocean sediments, materials tend to decompose at much lower rates than when exposed to seawater (Ankley 1996).

Floats would contain alkaline, lithium polymer, and lithium ion batteries; solar panels; Iridium modems; and other miscellaneous small electronics. Alkaline batteries no longer contain lead, have low toxicity, and are expected to have very localized effects on sediment or water quality. Lithium polymer batteries are more stable than other types of batteries and are non-toxic. Lithium ion batteries contain liquid electrolytes that are strong oxidants and highly reactive with water. The floats containing lithium batteries have been equipped with small solar panels to recharge the lithium batteries during the day and thereby reducing the overall number and size of lithium batteries needed for the floats to complete their mission. Therefore, each float with a lithium ion battery would release only a small amount of liquid electrolytes as well as lithium ion that would disperse in the water column and result in minimal impact.

Other materials in these float components include small quantities (less than 0.5 pounds) of other metals (iron, copper, silver, gold) and miscellaneous small plastic parts. When metals are exposed to seawater, they begin to slowly corrode, a process that creates a layer of corroded material between the seawater and uncorroded metal (Navy 2018a). This layer of corrosion removes the metal from direct exposure to the corrosiveness of seawater, a process that further slows movement of the metal ions into the adjacent sediments and water column. This is particularly true of aluminum. Elevated levels of metals in sediments would be restricted to a small zone around the metal, and any release to the overlying water column would be diluted. In a similar fashion, as materials become covered by marine life, both the direct exposure of the material to seawater and the rate of corrosion decrease. Dispersal of these materials in the water column is controlled by physical mixing and diffusion, both of which tend to vary with time and location (Navy 2018a).

The impacts of lead, copper, and lithium from expendable mobile anti-submarine warfare training targets, acoustic device countermeasures, sonobuoys, and torpedoes were studied at the Canadian Forces Maritime Experimental and Test Ranges near Nanoose Bay, British Columbia, Canada (Environmental Sciences Group 2005). These materials would also occur in the various float designs. The study found that these metal contaminants were most likely to concentrate on fine-grained particulate matter and did not cause a measurable effect on water quality (Environmental Sciences Group 2005).

A study by the Navy examined the impacts of materials from activated saltwater batteries in sonobuoys that freely dissolve in the water column (e.g., lead, silver, and copper ions), as well as nickel-plated steel housing, lead solder, copper wire, and lead shot used for sonobuoy ballast (Naval Facilities Engineering Command 1993). The study concluded that constituents released by saltwater batteries as well as the decomposition of other sonobuoy components did not exceed state or federal standards, and that the reaction products are short-lived in seawater.

Based on the small quantities of metals in floats, limited release of metal ions in the water column discussed above, the concentrations of metals from floats in any one location in the Study Area would be negligible.

Based on DARPA review of the initial proposed designs, the use of plastics in the floats was reduced by approximately 90 percent, with only 0.1 to 0.3 pound of plastic used in each float. In addition, most float components contain plastics that are sufficiently dense (e.g., PVC and ABS) and would sink to the bottom of the seafloor if they become detached from the float body. Materials that sink to the seafloor would be widely distributed over the large Study Area. Plastic debris that sink in the water column below the photic zone or to the seafloor would degrade more slowly than those on the surface or on land because of the lack of sunlight and oxygen and cooler temperatures.

Some small pieces of plastic may float, and these would likely persist in the marine environment with the same trajectory as other floating debris. However, the floats are intended to scuttle whole, and therefore small pieces of plastic are not expected to be released. As described under existing conditions, the worldwide use and disposal of plastics is rapidly increasing the amount of plastic debris accumulating in large areas of the world's oceans (Sheavly 2007; Moore et al. 2016). Dense plastic or metal debris resulting from the Proposed Action would sink, become encrusted or covered with sediment, and slowly degrade over time. Because of this, there would be minimal breakdown and release of micro plastics, resulting in negligible impacts on sediments or water quality. Overall, Phase 1a of the Ocean of Things program would contribute to the overall global problem of accumulating debris in the oceans. However, there would be a relatively small quantity of debris widely disbursed on the seafloor in the Study Area and negligible contribution of floating plastics. The potential effects of plastic debris from floats on living marine resources and habitats are analyzed in Section 3.3, *Marine Biological Resources*.

Hazardous substances found on marine vessels used to deploy floats would include petroleum, oil, and lubricants. All vessels used in transportation and deployment of floats would operate under protective guidelines specified in OPNAVM 5090.1 (Section 35-3.15) to protect against harmful discharges to marine waters, and would adhere to Coast Guard requirements regarding containment, cleanup, and reporting of spills (CWA Section 311). Any handling and disposal of spilled or oily waste material would be in accordance with an applicable Hazardous Waste Management Plan. Therefore, there would be no significant impact on marine water quality from petroleum, oil, and lubricants. If there were to be an accidental release of lubricant or fuel, it would not cause any significant long-term impact or harm water quality because the ships would immediately deploy emergency spill containment booms, mops, and other required containment and cleanup measures under the project specific Hazardous Waste Management Plan. In addition, most of the toxic components of lubricant and fuel (e.g., aromatics) evaporate and disperse within several hours to days, and are degraded by microorganisms (National Research Council 1985).

Based on the above analysis, implementation of Alternative 1 would not result in significant impacts to marine sediments and water quality, or result in significant harm to these resources on the global commons.

#### 3.4.3.2 Alternative 2

Consequences to sediments and water quality under Phase 1a Alternative 2 would be almost identical to consequences under Alternative 1, but at a lesser magnitude because the Alternative 2 Study Area essentially avoids the continental shelf where most biological activity occurs. Therefore, implementation of Alternative 2 would not result in significant impacts to marine sediments and water quality, or result in significant harm to these resources on the global commons.

## 3.5 Public Health and Safety

This section provides the analysis of potential impacts on public health and safety within the area potentially affected by the Ocean of Things program. Generally, the greatest potential for a proposed activity to impact the public is in nearshore areas because that is where public activities are most concentrated. The exposure of the public to the Ocean of Things activities and potential effects is limited by the location of float deployment well offshore in the SCB, and proposed scuttle locations that are at least 12 NM offshore. The main potential for exposure in these areas is associated with commercial and recreational boating and fishing.

### 3.5.1 Regulatory Setting

The requirements for public health and safety were derived from federal regulations, Department of Defense directives, and Navy instructions for training and testing. The directives and instructions provide specifications for mission planning and execution, including criteria for public health and safety considerations. The Navy employs standard operating procedures to provide for the safety of personnel and equipment as well as the success of the proposed activities.

In accordance with Title 33 CFR part 72 (Aids to Navigation), the U.S. Coast Guard publishes the Local Notice to Mariners on a weekly basis to inform private and commercial vessels about activities that may affect navigation. Notices are submitted for publication 14 days prior to the start of the activity. The notices alert the public to the nature of the activity, its location and timing, provide radio contact information and 24-hour phone contact, and identify any required closures, standoffs, and advise of the need for caution as appropriate. The Navy customarily provides Local Notice to Mariners for concentrated testing or survey activities, to facilitate the safety and success of the operation. The Navy will provide the requisite information to the U.S. Coast Guard 11$^{th}$ District for the Ocean of Things float deployments.

### 3.5.2 Affected Environment

The affected environment includes the transit routes used by the M/V Diane G or a similar vessel from NBPL, the deployment area south or west of San Clemente Island, and the potential extent of float drifting within the Study Area. The Study Area for the proposed Ocean of Things Program Phase 1a includes the Pacific Ocean off southern California and Baja California, generally south of the Channel Islands and extending offshore in the Pacific Ocean (Figures 2-1).

### 3.5.3 Environmental Consequences

#### 3.5.3.1 Alternative 1

Float deployment by the M/V Diane G or a similar vessel from NBPL involves routine procedures and vessel movement following standard Navy at-sea operating procedures, resulting in negligible risks to public health and safety during deployment.

There is some potential for floats to interact with commercial and recreational boaters and fishermen. However, floats would scuttle before entering nearshore areas where smaller boats and non-motorized recreational water users are present. Floats could be struck by vessels but would likely be pushed aside by boat wake due to small size. Floats could also become entangled in propellers or gear, raising the possibility that they would be handled – whether in order to disentangle them or out of curiosity. A sub-set of floats would have suspended attachments from only one float design in Phase 1a and would be weighted and suspended vertically to minimize chances of entanglement in fishing gear or propellers. The floats would be made of non-toxic materials and will be required to be designed so as minimize any risk to public health and safety if they were to be encountered and handled on the surface. This includes proper labeling (Section 2.1.3 and next paragraph) to mitigate injury from potential hazards.

Lithium ion batteries (associated with two of the three float designs) used in the floats can be susceptible to combustion if there is mechanical damage (e.g., crushing or puncturing) that leads to an internal short, potentially resulting in fire, venting of gases, flying metal shrapnel, harmful smoke, or an explosion, any of which would be dangerous to persons in the immediate vicinity. The risk of damage to persons and property is greatly reduced by the automatic scuttling of a damaged float, which would occur, for example, if the surface covering of the float was broken. However, if a damaged float were to become entangled with a vessel or otherwise picked up and handled, the risk would remain. Conspicuous labeling of the floats, as proposed, would provide warning to the public of the hazard and not to handle the floats, along with a designated government point-of-contact. To further minimize the risk of handling, suspended lines associated with one of the float designs would be 6.7 feet long and have sufficiently low breaking strength (i.e., 60 pounds) to separate from the float if the line were to become snagged on a vessel or fishing gear.

Once scuttled, the floats would sink in relatively deep water (at least 12 NM offshore) where contact with the public is very unlikely given the extreme rarity that a float would scuttle in the very small portion of the Study Area containing waters shallow enough for diving. In any case, there would be no risks to a diver that encountered and handled a float.

Accordingly, Alternative 1 would have no significant impacts on public health and safety and would be in compliance with EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*.

#### 3.5.3.2 Alternative 2

Consequences to public health and safety under Phase 1a Alternative 2 would be almost identical to consequences under Alternative 1, but at a lesser magnitude because the Alternative 2 Study Area essentially avoids the continental shelf where most small vessels and recreational activities occur. Therefore, implementation of Alternative 2 would not result in significant impacts to public health and safety, or result in significant harm to these resources on the global commons.

## 3.6 Summary of Potential Impacts to Resources and Impact Avoidance and Minimization

A summary of the potential impacts associated with the Proposed Action and the No Action Alternative are presented in Table 3.6-1.

**Table 3.6-1 Summary of Potential Impacts to Resource Areas**

| ***Resource Area*** | ***No Action Alternative*** | ***Alternative 1*** | ***Alternative 2*** |
|---|---|---|---|
| Marine Biological Resources | No Significant Impact or Harm. There would be no change in existing conditions; therefore, no impacts would occur. | No Significant Impact or Harm. Localized, minor, temporary disturbances to small areas of marine habitat, with no overall effect on quality and/or quantity of essential fish habitat. Temporary behavioral avoidance of deployment vessel by fish, sea turtles, seabirds, and marine mammals. During deployment, on-board observers would be aware of and ensure avoidance of risks to sea turtles and marine mammals. Potential localized and temporary disturbance or harm to benthic invertebrates from scuttled floats. | Similar to Alternative 1 but at a lesser magnitude because the Alternative 2 Study Area essentially avoids the continental shelf where most marine systems are more biologically productive. |
| Sediment and Water Quality | No Significant Impact or Harm. There would be no change in existing conditions; therefore, no impacts would occur. | No Significant Impact or Harm. Gradual disintegration of floats would add trace amounts of metals and plastics to small areas of sediment and water, without measurable change in sediment and water quality. | Similar to Alternative 1 but at a lesser magnitude because the Alternative 2 Study Area essentially avoids the continental shelf where most biological activity occurs. |

## Table 3.6-1 Summary of Potential Impacts to Resource Areas

| ***Resource Area*** | ***No Action Alternative*** | ***Alternative 1*** | ***Alternative 2*** |
|---|---|---|---|
| Public Health and Safety | No Significant Impact or Harm. There would be no change in existing conditions; therefore, no impacts would occur. | Precautions would be taken as needed to minimize hazards during deployment; Local Notice to Mariners would alert public to float deployment; floats would be labeled to identify any hazards and proper handling if encountered; deployment vessel would observe standard operating procedures to avoid risks to public. | Similar to Alternative 1 but at a lesser magnitude because the Alternative 2 Study Area essentially avoids the continental shelf where most small vessels and recreational activities occur. |

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# 4 Cumulative Impacts

This section (1) defines cumulative impacts, (2) describes past, present, and reasonably foreseeable future actions relevant to cumulative impacts, (3) analyzes the incremental interaction the proposed action may have with other actions, and (4) evaluates cumulative impacts potentially resulting from these interactions.

## 4.1 Definition of Cumulative Impacts

The approach taken in the analysis of cumulative impacts follows the objectives of the NEPA, CEQ regulations, and CEQ guidance. Cumulative impacts are defined in 40 CFR Section 1508.7 as "the impact on the environment that results from the incremental impact of the action when added to the other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

To determine the scope of environmental impact analyses, agencies shall consider cumulative actions, which when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact analysis document.

In addition, CEQ and USEPA have published guidance addressing implementation of cumulative impact analyses—Guidance on the Consideration of Past Actions in Cumulative Effects Analysis (CEQ 2005) and Consideration of Cumulative Impacts in Environmental Protection Agency Review of NEPA Documents (USEPA 1999). CEQ guidance entitled Considering Cumulative Impacts Under NEPA (1997) states that cumulative impact analyses should

"…determine the magnitude and significance of the environmental consequences of the proposed action in the context of the cumulative impacts of other past, present, and future actions...identify significant cumulative impacts…[and]…focus on truly meaningful impacts."

Cumulative impacts are most likely to arise when a relationship or synergism exists between a proposed action and other actions expected to occur in a similar location or during a similar time period. Actions overlapping with or in close proximity to the proposed action would be expected to have more potential for a relationship than those more geographically separated. Similarly, relatively concurrent actions would tend to offer a higher potential for cumulative impacts. To identify cumulative impacts, the analysis needs to address the following three fundamental questions.

- Does a relationship exist such that affected resource areas of the proposed action might interact with the affected resource areas of past, present, or reasonably foreseeable actions?
- If one or more of the affected resource areas of the proposed action and another action could be expected to interact, would the proposed action affect or be affected by impacts of the other action?
- If such a relationship exists, then does an assessment reveal any potentially significant impacts not identified when the proposed action is considered alone?

## 4.2 Scope of Cumulative Impacts Analysis

The scope of the cumulative impacts analysis involves both the geographic extent of the effects and the time frame in which the effects could be expected to occur. In general, for this EA/OEA, the analysis of cumulative impacts focuses on impacts in the Study Area. However, any reasonably foreseeable effects that may affect areas outside of the Study Area are considered, as relevant. The Study Area will include those areas previously identified in Chapter 3 for the respective resource areas. The time frame for cumulative impacts centers on the timing of the Proposed Action.

Another factor influencing the scope of cumulative impacts analysis involves identifying other actions to consider. Beyond determining that the geographic scope and time frame for the actions interrelate to the proposed action, the analysis employs the measure of "reasonably foreseeable" to include or exclude other actions. For the purposes of this analysis, public documents prepared by federal, state, and local government agencies form the primary sources of information regarding reasonably foreseeable actions. Documents used to identify other actions include notices of intent for EISs and EAs, management plans, land use plans, and other planning related studies.

## 4.3 Past, Present, and Reasonably Foreseeable Actions

This section will focus on past, present, and reasonably foreseeable future projects at and near the Proposed Action locale. In determining which projects to include in the cumulative impacts analysis, a preliminary determination was made regarding the past, present, or reasonably foreseeable action. Specifically, using the first fundamental question included in Section 4.1, it was determined if a relationship exists such that the affected resource areas of the Proposed Action (included in this EA/OEA) might interact with the affected resource area of a past, present, or reasonably foreseeable action. If no such potential relationship exists, the project was not carried forward into the cumulative impacts analysis. In accordance with CEQ guidance (CEQ 2005), these actions considered but excluded from further cumulative effects analysis are not catalogued here, as the intent is to focus the analysis on the meaningful actions relevant to informed decision-making. Projects included in this cumulative impacts analysis are described in the following subsections.

### 4.3.1 Past Actions

- *Southern California Range Complex*: In 2008, the Navy completed the Southern California (SOCAL) Range Complex EIS/OEIS (Navy 2008). The SOCAL Range Complex EIS/OEIS addressed the potential environmental impacts associated with ongoing and proposed naval activities within the Navy's existing SOCAL Range Complex. The SOCAL Range Complex encompasses surface and subsurface ocean operating areas, over-ocean military airspace, and Naval Auxiliary Landing Field (NALF), San Clemente Island.
- *Hawaii-Southern California Training and Testing*: In 2013, the Navy completed the HSTT EIS/OEIS (Navy 2013a). The HSTT EIS/OEIS addressed the potential environmental impacts associated with the current, emerging, and future training and testing activities in the Hawaii-Southern California Study Area from 2014 through 2018.

### 4.3.2 Present and Reasonably Foreseeable Actions

#### 4.3.2.1 Federal Actions

- *Fiber Optic Communications Undersea System Replacement*: The Navy proposes to replace an existing fiber optic communications undersea system with a new system that will connect Naval Base Ventura County Point Mugu, Naval Base Ventura County San Nicolas Island, and Santa Cruz

Island. The Final Draft EA was released in September 2018 (Navy 2018b) and the Finding of No Significant Impacts statement was signed on 29 October 2018.

- *Hawaii-Southern California Training and Testing*: The Navy is conducting training and testing activities—which include the use of active sonar and explosives—primarily within existing range complexes and operating areas located along the coast of southern California and around the Hawaiian Islands. Navy operating areas include designated ocean areas near fleet homeports. Activities also include sonar training and gunnery exercises conducted concurrently with ship transits and which may occur outside Navy range complexes and testing ranges. Pierside sonar testing conducted as part of overhaul, modernization, maintenance, and repair activities at shipyards and Navy piers is also ongoing. A new Final EIS/OEIS addresses these activities as they currently occur and are anticipated to continue in the future (Navy 2018a).
- *Point Mugu Sea Range:* The Navy is preparing a new EIS/OEIS for the Point Mugu Sea Range and proposes to continue conducting testing and training activities within the Point Mugu Sea Range as analyzed in the 2002 EIS/OEIS. The majority of the proposed testing and training activities to be analyzed in the new EIS/OEIS are similar to those that have occurred in the Point Mugu Sea Range for decades. The Proposed Action also accommodates an increase in the frequency of activities, new mission areas, and new platforms (such as aircraft and vessels).
- *Maritime Surveillance System Test Bed at San Clemente Island*: The Navy proposes the installation and operation of the Maritime Surveillance System Test Bed (MSS-TB), which consists of offshore submarine cables and an upland shore processing facility at NALF San Clemente Island, and the acquisition of a MSS-TB support ship (Navy 2018c). Initially, the MSS-TB support ship would be leased; and at a later date, the same or similar ship would be purchased. The project also includes MSS-TB support ship transit, pre-deployment equipment calibration, and berthing at Naval Base Ventura County, Port Hueneme.
- *Replacement of Surface Ship Radiated Noise Measurement Array*: The Navy proposes to repair by replacement the Surface Ship Radiated Noise Measurement system in the ocean off San Clemente Island. The system consists of a fixed hydrophone array and an undersea data transmission cable (trunk cable) connected to a shore station. The system uses hydrophones to receive noise (i.e., propulsion, ship machinery and flow noise) coming from Navy ships as they routinely operate in the training area (Naval Sea Systems Command 2017).
- *Academic Research*: Wide-scale academic research is conducted in the Study Area by federal entities, such as the Navy and the NOAA/NMFS, as well as state and private entities and other partnerships, such as the California Cooperative Oceanic Fisheries Investigations program. Although academic research aims to capture data without disturbing the ambient conditions of the ocean environment, vessels contribute traffic, noise, and strike hazard; seismic activity contributes noise; drifters and buoys can result in ingestion and entanglement; and various other collection methods, such as trawling, could be disruptive to the ecosystems under observation.
- *Phase 1b and Phase 2 of the Ocean of Things Program*. As outlined in Section 1.2, Phase 1b and Phase 2 of the Ocean of Things program could occur following assessment of the outcomes of this Phase 1a test. Phase 1b would include up to 3,350 floats from the three designs, released in the SCB and allowed to freely drift for up to 3 months in a larger Study Area than for Phase 1a. Phase 2 would include up to 15,000 floats, released in the SCB and allowed to freely drift for up

to 9 months in a larger Study Area than for Phases 1a and 1b. Only floats designs that demonstrate reliable float performance would be deployed in each subsequent phase. In addition, float designs, deployment locations/strategies, and program objectives may be modified based on performance in each prior phase.

- *Testing for the Ocean of Things Program in Other Regions*. DARPA would continue to explore opportunities to partner with federal and non-federal research partners to conduct testing of Ocean of Things floats in other geographic regions. The scale and location of such testing would depend on capabilities of regional partners and data of interest in specific regions (e.g., oceanographic patterns in the Gulf of Mexico).

#### 4.3.2.2 Non-federal Actions

The cumulative projects summarized below are described in detail in the HSTT EIS/OEIS (Navy 2018a):

- *Commercial Transportation and Shipping*: The California coast is heavily traveled by commercial, recreational, and government marine vessels with several commercial ports. Primary environmental concerns regarding increased maritime traffic include vessels striking marine mammals and sea turtles, introduction of non-native species through ballast water, and underwater sound from ships and other vessels. Additionally, air and water quality in busy ports can be diminished due to engine emissions and fuel leaks. Secondary impacts include development and maintenance of port infrastructure, which often include dredging requirements to maintain channel depths and habitat loss and degradation in coastal habitats.
- *Commercial and Recreational Fishing*: Commercial fishing can adversely affect fish populations, non-target species, and habitats. Bycatch includes the unintentional capture of fish, marine mammals, sea turtles, seabirds, and other non-targeted species that occur incidental to normal fishing operations. Fisheries bycatch has been identified as a primary driver of population declines in several groups of marine species, including sharks, mammals, seabirds, and sea turtles (Wallace et al. 2010). Commercial fishing often includes the use of mobile fishing gear, such as bottom trawls, which increases turbidity, alters sediment and bottom habitats, removes prey (leading to declines in predator abundance), removes predators, and generates marine debris. Ghost fishing occurs when lost and abandoned fishing gear, such as gill nets, purse seines, and long lines, continue to ensnare fish and other marine animals without human oversight and removal. Lost gear fouls and disrupts bottom habitats and has the potential to entangle, or be ingested by marine mammals.

  Recreational fishing is significant in southern California, where over 3.3 million days of recreational fishing were recorded in 2013 (NMFS 2015). More than 200 for-hire fishing vessels operate from 15 separate ports between Point Conception and the U.S.–Mexico border (California Marine Life Protection Act Initiative 2009). Recreational fishing includes impacts from vessel traffic (strike, noise, water pollution, marine debris) and can compound impacts on fish stocks already experiencing exploitation. Recreational fishing and boat traffic usually occurs nearshore rather than in the deeper open ocean, and recreational traffic typically frequents popular locations, which can concentrate damage in these areas from anchors or other bottom disturbing equipment.
- *Coastal Land Development and Tourism*: Coastal land development in southern California is both intensive and extensive, including development of homes, businesses, recreation, vacation, and

ship traffic at port facilities and marinas. The coastline also includes extensive coastal tourism (hotels, resorts, restaurants, food industry, and vacation homes) and its supporting infrastructure (retail businesses, marinas, fishing tackle stores, dive shops, fishing piers, recreational boating harbors, beaches, and recreational fishing and whale watching). New development in the coastal zone requires a permit from the state or local government per the Coastal Zone Management Act.

Tourism is a substantial industry in southern California (National Ocean Economics Program 2015). Coastal development intensifies use of coastal resources through dune and nearshore habitat loss and disturbance, point and nonpoint source water pollution, entrainment in outflows and other structures, and air quality degradation. SCUBA diving and snorkeling have the potential to degrade reef systems through disturbance and specimen collecting, and collisions between whale watching ships and whales are common.

- *Offshore Oil and Gas Production*: Oil and gas production facilities and wells are located off the coast of southern California. Potential impacts associated with these activities include those associated with noise, traffic, waste discharges, sediment disturbance, and risk of accidental spills. These impacts are generally assumed to be negligible due to the dispersed and relatively small footprint of normal operations. In the event of small to catastrophic spills, however, impacts grow increasingly detrimental to marine life.

## 4.4 Cumulative Impact Analysis

Where feasible, the cumulative impacts were assessed using quantifiable data; however, for many of the resources included for analysis, quantifiable data is not available and a qualitative analysis was undertaken. In addition, where an analysis of potential environmental effects for future actions has not been completed, assumptions were made regarding cumulative impacts related to this EA/OEA where possible. The analytical methodology presented in Chapter 3, which was used to determine potential impacts to the various resources analyzed in this document, was also used to determine cumulative impacts.

### 4.4.1 Marine Biological Resources

#### 4.4.1.1 Description of Geographic Study Area

For purposes of marine biological resources, the Study Area includes the Pacific Ocean off southern California and Baja California, generally south of the Channel Islands and extending offshore in the Pacific Ocean, as described in Section 3.3.2.

#### 4.4.1.2 Relevant Past, Present, and Future Actions

Past, present, or reasonably foreseeable projects affecting the ocean surface and bottom in the Study Area are considered in the cumulative impact analysis for marine biological resources. Past and present projects are reflected in baseline conditions and regulatory protection that has been enacted for impacted and vulnerable species, groups of species, and habitats. Regulatory compliance is thus critical in assuring that cumulative impacts are avoided.

#### 4.4.1.3 Cumulative Impact Analysis

The activities that have the greatest potential to overlap with the Proposed Action are Navy testing and training that affect the surface waters and benthic habitats of much of the Study Area. Project planning, conservation measures, and regulatory compliance have assured that the corresponding impacts of this Navy testing and training are minimized and less than significant (Navy 2002, 2013a, 2018a). In particular, the areas of potential disturbance by ship movements and the deposition of expended materials are very small in relation to the available habitat. As discussed in Section 3.3.3, the incremental effects of the Ocean of Things project would be minimal, localized, and temporary, below levels that could foreseeably interact with the effects of other projects. As a result, the Proposed Action would not result in significant cumulative impacts on marine biological resources.

The information provided by the Ocean of Things project, in combination with other ocean monitoring in the region would have a beneficial cumulative effect on biological resources through the accumulation of knowledge that improves our understanding of the physical and biological environment of the Study Area and fosters better decision making and management.

### 4.4.2 Sediments and Water Quality

#### 4.4.2.1 Description of Geographic Study Area

For purposes of marine sediments and water quality resources, the Study Area includes the Pacific Ocean off southern California and Baja California, generally south of the Channel Islands and extending offshore in the Pacific Ocean, as described in Section 3.4.2.

#### 4.4.2.2 Relevant Past, Present, and Future Actions

Past, present, or reasonably foreseeable projects in the Study Area are considered in the cumulative impact analysis for marine sediments and water quality.

#### 4.4.2.3 Cumulative Impact Analysis

The Proposed Action would have only localized effects, if any, on marine sediment and water quality. Such effects are limited to minor disruption of sediments on the seafloor, and the low likelihood of inadvertent discharges from project vessels, which would be contained and cleaned up in accordance with Navy policy. As described in the HSST EIS/OEIS (Navy 2018a), previous, ongoing, and proposed future actions in support of training and the Research Development Test and Evaluation are not expected to measurably affect sediment quality, or to result in violations of water quality standards and criteria because pollutants are released in relatively small quantities and are dispersed widely in the environment.

Population growth is the primary cause of impacts on coastal water quality, including marine debris, land-based garbage, and solid wastes that deposit toxic chemicals and nutrients in the ocean. Water quality in the Study Area tends to be rated from good to poor, and is often compromised due to increased use of and development in coastal waters. The worldwide use and disposal of plastics is rapidly increasing the amount of plastic debris accumulating in large areas of the world's oceans. Most of this, and certainly the most harmful components, are floating on the surface. The Ocean of Things program could provide a better understanding of such floating debris drifts on ocean currents. Plastic or metal debris resulting from the Proposed Action would sink, become encrusted or covered with sediment, and slowly degrade over time, resulting in a negligent contribution to overall marine debris accumulation in the Study Area.

Due to the limited scope of potential sediment and water quality impacts associated with the Proposed Action, the action would have only minor, temporary effects, if any, and would not measurably add to quantities of pollutants in the marine environment. Hence, there would be no cumulative impact on marine sediments and water quality.

### 4.4.3 Public Health and Safety

#### 4.4.3.1 Description of Geographic Study Area

For purposes of public health and safety, the Study Area includes the Pacific Ocean off southern California and Baja California, generally south of the Channel Islands and extending offshore in the Pacific Ocean, as described in Section 3.5.2.

#### 4.4.3.2 Relevant Past, Present, and Future Actions

Past, present, or reasonably foreseeable projects in the Study Area are considered in the cumulative impact analysis for marine sediments and water quality.

#### 4.4.3.3 Cumulative Impact Analysis

As described in section 3.5, the potential impacts of the Proposed Action on public health and safety would be minimal. Hence, the Proposed Action would not contribute to cumulative impacts on public health and safety.

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# 5 Other Considerations Required by National Environmental Policy Act

## 5.1 Consistency with Other Federal, State, and Local Laws, Plans, Policies, and Regulations

In accordance with 40 CFR Section 1502.16(c), analysis of environmental consequences shall include discussion of possible conflicts between the Proposed Action and the objectives of federal, regional, state and local land use plans, policies, and controls. Table 5-1 identifies the principal federal and state laws and regulations that are applicable to the Proposed Action, and describes briefly how compliance with these laws and regulations has been or would be accomplished.

**Table 5-1 Status of Compliance with Laws Applicable to the Proposed Action**

| *Applicable Law* | *Responsible Agency* | *Status of Compliance* |
|---|---|---|
| NEPA (42 U.S.C. 4321-4370h); CEQ NEPA implementing regulations (40 CFR parts 1500-1508); Navy procedures for Implementing NEPA (32 CFR part 775) | Navy | In compliance: this document |
| Clean Air Act (42 U.S.C. 7401 et seq.) | CARB | In compliance: Record of Non-Applicability prepared (see Appendix B) |
| Clean Water Act (33 U.S.C. 1251 et seq.) (40 CFR 125) | U.S. Army Corps of Engineers, California Regional Water Quality Control Boards | In compliance: no discharge to waters would occur |
| Coastal Zone Management Act/California Coastal Act (16 U.S.C. 1451 et seq.) | California Coastal Commission | In compliance: no effect |
| National Historic Preservation Act (54 U.S.C. 300101 et seq.) | California State Historic Preservation Officer | In compliance: no effect, consultation not required |
| Endangered Species Act (ESA) (16 U.S.C. 1531 et seq.) | USFWS and NMFS | In compliance: not likely to adversely affect, informal consultation and concurrence, formal consultation not required |
| Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (16 U.S.C. 1801 et seq.) (50 CFR 600 et seq.) | NMFS | In compliance: less than minimal effect on essential fish habitat, conservation recommendations will be considered during consultation |
| Marine Mammal Protection Act (16 U.S.C. 1361 et seq.) | NMFS | In compliance: no foreseeable takes of marine mammals, consultation/take authorization not required |
| National Marine Sanctuaries Act (16 U.S.C. 1431) | NOAA | In compliance: no effect, Study Area is located away from any National Marine Sanctuary |
| Migratory Bird Treaty Act (16 U.S.C. 703-712) | USFWS | In compliance: no significant adverse effect on a population of a migratory bird species |

**Table 5-1 Status of Compliance with Laws Applicable to the Proposed Action**

| *Applicable Law* | *Responsible Agency* | *Status of Compliance* |
|---|---|---|
| Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.) | USFWS | In compliance: not expected to result in any incidental takes bald or golden eagles |
| Ocean Dumping Act (16 U.S.C. 1431-1447 and 33 U.S.C. 1401-1445 and 2801-2805) | USEPA | In compliance: No waste material will be disposed of in the ocean under the proposed action. All float packing materials used in transport would remain aboard the vessel and would be recycled. |
| EO 11988, *Floodplain Management*, as amended by EO 12148 | Navy | In compliance: no effect, Study Area is located away from any floodplain |
| EO 12088, *Federal Compliance with Pollution Control Standards*, as amended by EO 12580, as revoked, in part, by EO 13148 | USEPA | In compliance: this document |
| EO 12114, *Environmental Effects Abroad of Major Federal Actions* | Navy | In compliance: this document |
| EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations*, as amended by EO 12948 | Navy | In compliance: no effect on minority or low-income populations |
| EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks* | Navy | In compliance: no health and safety risks to children |
| EO 13158 *Marine Protected Areas* | Navy | In compliance: floats would be scuttled before entering marine protected area boundaries |
| EO 13175, *Consultation and Coordination with Indian Tribal Governments* | Navy/Tribal governments | In compliance: no tribal jurisdiction or resources affected |
| EO 13186, *Responsibility of Federal Agencies to Protect Migratory Birds* | Navy | In compliance: no effect on migratory birds |
| EO 13840, *Ocean Policy to Advance the Economic, Security, and Environmental Interests of the United States*. Revokes and replaces EO 13547 | Navy | In compliance: the Proposed Action is consistent with the goal of EO 13840, which is to advance the economic, security, and environmental interests of the United States through improved public access to marine data and information |

## 5.2 Irreversible or Irretrievable Commitments of Resources

Resources that are irreversibly or irretrievably committed to a project are those that are used on a long-term or permanent basis. This includes the use of non-renewable resources such as metal and fuel, and natural or cultural resources. These resources are irretrievable in that they would be used for this project when they could have been used for other purposes. Human labor is also considered an irretrievable resource. Another impact that falls under this category is the unavoidable destruction of natural resources that could limit the range of potential uses of that particular environment.

The total amount of materials (e.g., float materials and components) required for the Proposed Action is relatively small when compared to the resources available in the region. The materials and energy required for deployment of floats are not in short supply. Moreover, the use of materials and energy would not have an adverse impact on the continued availability of these resources.

## 5.3 Unavoidable Adverse Impacts

This EA/OEA has determined that the Proposed Action would not result in any significant impacts. No resource area would be subject to significant adverse impacts that would require mitigation.

## 5.4 Relationship between Short-Term Use of the Environment and Long-Term Productivity

NEPA requires an analysis of the relationship between a project's short-term impacts on the environment and the effects that these impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment. Impacts that narrow the range of beneficial uses of the environment are of particular concern. This refers to the possibility that choosing one development site reduces future flexibility in pursuing other options, or that using a parcel of land or other resources often eliminates the possibility of other uses at that site.

Short-term uses of the environment associated with the Proposed Action would include Phases 1a float operations in the Pacific Ocean off of southern California and Baja California. Deployment of floats during Phases 1a would temporarily increase air pollution emissions in the immediate vicinity of the affected area.

As discussed in Chapter 3, the Proposed Action would result in both short- and long-term environmental effects. However, no element of the Proposed Action is expected to result in the types of impacts that would reduce environmental productivity, have long-term impacts on sustainability, affect biodiversity, or narrow the range of long-term beneficial uses of the environment. In summary, implementation of the Proposed Action would not result in any impacts that would significantly reduce environmental productivity or permanently narrow the range of beneficial uses of the environment.

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Matt Lybolt, Ph.D., Marine Ecology, Senior Marine Biologist, 19 years' experience

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Lisa Woeber, B.B.A. Business Administration, Quality Control, 20 years' experience

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# Appendix A
# Public and Agency Correspondence

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**DEPARTMENT OF THE NAVY**
NAVAL INFORMATION WARFARE SYSTEMS COMMAND
4301 PACIFIC HIGHWAY
SAN DIEGO, CA 92110-3127

5090
Ser 5.0/918
October 28, 2019

Mr. Barry Thom
Regional Administrator
National Marine Fisheries Service
501 West Ocean Boulevard
Long Beach, CA 90802-4213

Attention: Ms. Penny Ruvelas

Dear Mr. Thom:

SUBJ: SECTION 7 CONSULTATION AND ESSENTIAL FISH HABITAT ASSESSMENT FOR THE AT-SEA TESTING OF THE OCEAN OF THINGS PROGRAM

The United States Navy's Naval Information Warfare Systems Command (NAVWAR), requests informal section 7 consultation for the Navy's proposed at-sea testing for Phase 1a of the Ocean of Things program in the Pacific Ocean offshore of southern California and Baja California. This letter serves to transmit the Navy's Essential Fish Habitat (EFH) Assessment, enclosure (1). This letter also transmits the analysis of the project's effects on Endangered Species Act-listed species under jurisdiction of the National Marine Fisheries Service, enclosure (2).

Phase 1a of the Ocean of Things program would consist of the deployment of up to 1,000 small, non-recoverable, freely drifting floats for one month to measure environmental conditions and detect anthropogenic activity. The purpose of the program is to develop a cost-effective, low-environmental impact technology to characterize an oceanographic region by collecting and analyzing environmental and activity data at a scale and resolution that is currently not available. The Proposed Action is needed to fill a gap in maritime situational awareness by providing a regional, multivariate, high-resolution, near real-time picture from a distributed sensor network on the ocean. The Ocean of Things program and the Phase 1a test are further described in enclosure (1) to this letter.

The Navy had the opportunity to discuss the Ocean of Things program with NMFS West Coast Region representatives several times over the last year in order to gain insight into potential areas of concern, as well as to invite input into the overall approach to the program. This included an informational meeting held at Southwest Fisheries Science Center on 22 February 2018; DARPA's Community of Interest meeting held on March 15, 2019 in La Jolla; and a discussion of the project via phone with NMFS West Coast Region staff on March 29, 2019.

NAVWAR requests NMFS concurrence with the assessment of effects on EFH under the Magnuson-Stevens Act in table 5-2 of enclosure (1). NAVWAR also requests written concurrence, via email or letter, from NMFS on the finding of "may affect, not likely to adversely affect," for threatened and endangered species listed in table 1 of enclosure (2) within 60 days of receipt of this request per the new regulation §402.13(c)(2) that takes effect on October 28, 2019.

If you have any questions or need further information, please contact Mr. Jerry Olen at jerry.olen@navy.mil or 619-553-1443. Thank you for your attention to this matter.

GREG SHAFFER
Deputy Warranting Officer
By direction of the Commander

Enclosure: 1 Essential Fish Habitat Assessment for the At-Sea Testing of the Ocean of Things Program
2 Section 7 Informal Consultation for the At-Sea Testing of the Ocean of Things Program

Copy to: NIWC Pacific (Code 56/71)

**Enclosure 1**

# ESSENTIAL FISH HABITAT ASSESSMENT

# for the At-Sea Testing of the

# Ocean of Things Program

**October 2019**

DARPA

NAVWAR

Naval Information Warfare Center PACIFIC

DEPARTMENT OF THE NAVY UNITED STATES OF AMERICA

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# ESSENTIAL FISH HABITAT ASSESSMENT for the At-Sea Testing of the Ocean of Things Program

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# Abbreviations and Acronyms

| Acronym | Definition |
| --- | --- |
| EFH | essential fish habitat |
| FMP | Fishery Management Plan |
| ft | Foot/feet |
| HAPC | Habitat Area(s) of Particular Concern |
| m | meter(s) |
| $m^2$ | square meter(s) |
| MSFMCA | Magnuson-Stevens Fishery Conservation and Management ActAct |
| M/V | marine vessel |
| NAVWAR | Naval Information Warfare Systems Command |
| NBVC | Naval Base Ventura County |
| NEPA | National Environmental Policy Act |
| NIWC | Naval Information Warfare Center |
| NMFS | National Marine Fisheries Service |
| U.S.C. | U.S. Code |

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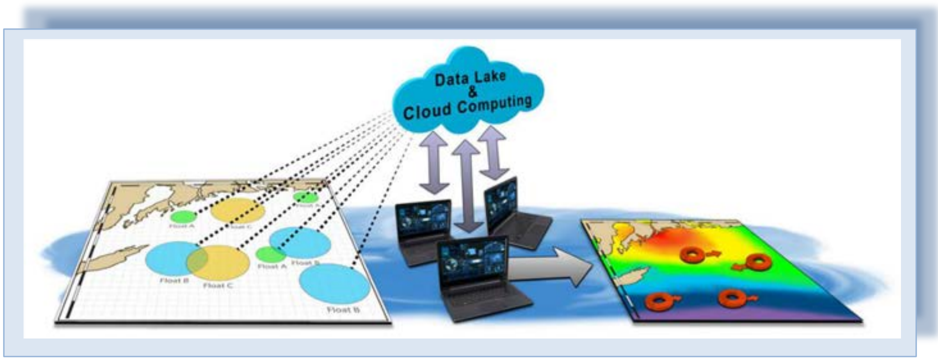
# 1 Introduction

Many marine habitats are critical to the productivity and sustainability of marine fisheries. The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) set forth the Essential Fish Habitat (EFH) provisions to identify and protect important habitats of federally managed marine and anadromous fish species. Section 305(b)(2) of the amended MSFCMA directs each federal agency to consult with the National Marine Fisheries Service (NMFS) with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency that may adversely affect any EFH identified under the MSFCMA. Implementing regulations for this requirement are in 50 Code of Federal Regulations (CFR) 600.

The proposed project is located within an area designated as EFH for three Fishery Management Plans (FMPs): the Coastal Pelagics, Highly Migratory Species, and Pacific Coast Groundfish (Pacific Fishery Management Council [PFMC] 2016a, 2016b, 2016c). In addition, Habitat Areas of Particular Concern (HAPC) are also designated for the Pacific Coast Groundfish FMP. The objective of this assessment is to determine whether the Proposed Action "may adversely affect" designated EFH for relevant federally managed commercial species. The definition of adverse effect is "any impact that reduces the quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate" (CFR 600.910[a]).

This EFH Assessment was prepared in conformance with the MSFCMA to address a proposal by the Naval Information Warfare Systems Command (NAVWAR), Naval Information Warfare Center (NIWC) Pacific to conduct Phase 1a at-sea testing of the Defense Advanced Research Projects Agency's (DARPA) Ocean of Things program. The project location includes the Pacific Ocean offshore of southern California and Baja California, overlapping the Navy's Southern California Range Complex, adjacent waters of the U.S. and Mexico Exclusive Economic Zones, and high seas of the global commons. Federal action agencies, which fund, permit, or carry out activities that may adversely affect EFH are required to consult with NMFS regarding the potential effects of their actions on EFH, and respond in writing to the fisheries service's recommendations. The Navy and NMFS signed an agreement in 2001 under which the Navy will notify NMFS in writing as early as practicable regarding actions that may adversely affect EFH. Notification will facilitate discussion of measures to conserve EFH.




For any Federal action that may adversely affect EFH, Federal agencies must provide NMFS with a written assessment of the effects of that action on EFH. The level of detail required in the assessment is commensurate with the magnitude of potential adverse effects.

## 1.1 Ocean of Things Program Overview

The Internet of Things connects an ever-growing number of smart devices for up-to-the-minute monitoring and tracking of many common events. However, in most parts of the open ocean, no such capability exists for real-time monitoring of maritime activity or conditions. The Ocean of Things program is a research and development effort that aims to provide the expanded information capabilities associated with the Internet of Things to the ocean in a cost-effective way, taking advantage of developments in cloud-based analytic techniques to assess maritime conditions and contribute to oceanographic models in near real-time. Ocean of Things is an initiative of the DARPA's Strategic Technology Office, which focuses on technologies that increase military effectiveness through the use of networks, cost leveraging, and adaptability. The objective of the program is to provide environmental sensing and operational surveillance missions by developing new low-cost methods for detection and tracking of objects and characterization of oceanographic phenomena at a fine scale over broad areas. The inputs for these data analytics over a large ocean area would be provided by deploying thousands of small, low-cost smart floats to form a distributed sensor network.

The floats are designed to drift freely on the ocean surface with surface currents. Each smart float contains a suite of commercially available sensors to collect environmental data, such as ocean temperature, sea state, salinity, and location, which will enable analysis of conditions and activities in the area. The floats would transmit data periodically via Iridium satellite Short Burst Data to a shore-side data cloud for storage and near real-time analysis, resulting, for example, in surface current tracking, identification of vessel activity, and monitoring of changing meteorological conditions. At the end of the designated period of data collection, or if the floats lose vital capabilities such as communications, the floats would scuttle (i.e., sink to the ocean bottom). Additionally, the floats would scuttle before crossing a designated geofence (i.e., a virtual set of geographic boundaries programmed into the floats, defined using Global Positioning System [GPS] parameters, beyond which the floats would not be allowed to travel). This geofence would be located to prevent floats from potentially going ashore, entering sensitive marine areas, or interacting with shallow habitats. The geofence will also minimize interaction between the floats and members of the general public, thus minimizing any potential health and safety risks. The floats are designed to minimize their end-of life footprint by making use of innovative materials, minimizing use of plastics, and staying within a small overall volume.

To effectively develop, demonstrate, and evaluate this evolving technology, the Ocean of Things program would consist of three distinct at-sea test phases:

- **Phase 1a: release of up to 1,000 floats for a 1-month period in a limited Study Area (this EFHA)**
- Phase 1b: release of up to 3,350 floats for a 3-month period in an expanded Study Area
- Phase 2: release of up to 15,000 floats for a 9-month period in an expanded Study Area

Each subsequent phase is defined by separate requirements and broadening objectives, which may involve alterations to design, programming, data processing, location, and/or number of floats released as the Ocean of Things program progresses. This approach results in distinct outcomes and decision points for each phase. Following the implementation of Phase 1a, in which three float designs would be tested, the Navy and DARPA would assess the demonstrated data analytics capabilities and performance of the floats. Any future proposal to implement Phase 1b would be conditional on the demonstrated success of Phase 1a. Similarly, any future proposal to implement Phase 2 would be conditional on the demonstrated success of Phases 1a and 1b. DARPA may re-evaluate and revise program objectives using lessons learned at the conclusion of Phase 1a. The suitability of the above phased approach in the waters off southern California may be re-evaluated at that time.

Phase 1a float deployment is being analyzed in this EFH Assessment. Three float designs are proposed for Phase 1a. For purposes of analysis, it is assumed that each float design would represent approximately one-third of the 1000 floats to be deployed in Phase 1a. Each float design would progress through test phases independently; therefore, one-month deployments of each type of float may or may not be concurrent. Each float design would not be deployed under Phase 1a off southern California until the Navy independently tests and demonstrates the reliability of the geofence and scuttling capabilities.

Contingent upon the results of Phase 1a, testing and deployments under both Phase 1b and Phase 2 would be analyzed in separate Supplemental EFH Assessment to this assessment. Distinct phase objectives, outcomes of prior phases, and any alterations to float designs would inform any future consultations with various agencies for each subsequent phase. The deployment of future phases is contingent on securing the necessary permits and authorizations.

This phased approach is necessitated by an interest in developing, testing, and evaluating original, cutting-edge technologies while fully complying with the requirements of NEPA. The phases are designed to establish and document float reliability in controlled and limited deployments that build upon lessons learned as a means of responsibly expanding the scope of each phase of the program. If Phase 1a fails to demonstrate reliable float performance, the Navy would not proceed to Phase 1b as described and would re-evaluate the approach to the Ocean of Things program.

## 1.2 Location

The project location is in the Pacific Ocean off southern California and Baja California, generally south of the Channel Islands and extending offshore in the Pacific Ocean (Figure 1-1). This area was chosen due to its diversity of environments and likelihood of obtaining quality data to test the Ocean of Things programmatic requirements and proximity to NIWC research, development, test, and evaluation (RDTE) facilities in San Diego and to other Navy support facilities (e.g., Navy-owned San Clemente Island). Further, the waters off southern California are relatively well monitored by other research programs, compared to other ocean locations, providing valuable ground-truth data. This area provides not only commercial, private, and military vessels for observation, but also contains an abundance of fishing and marine mammal activity. This activity combined with consistent weather patterns will enable obtaining a rich data set compared to other regions. These ideal conditions would aid the development of this technology.

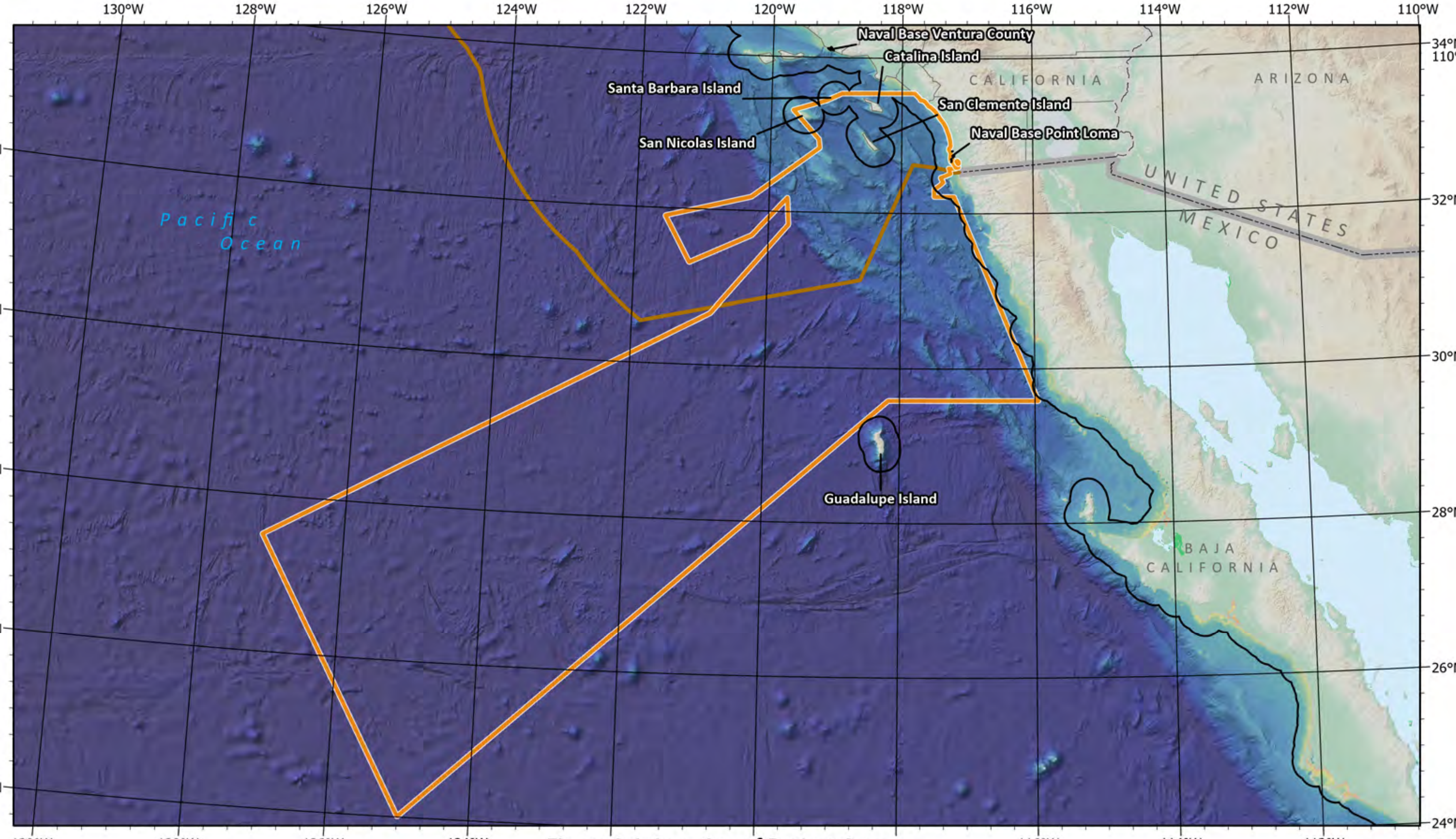
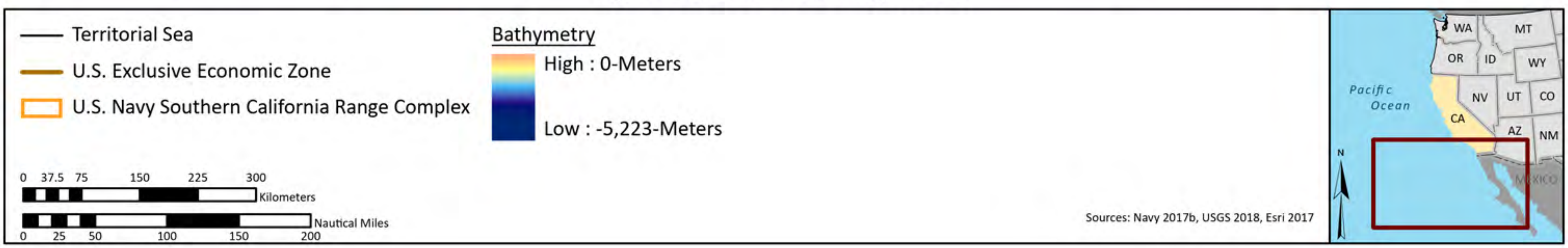



Figure 1-1. Location of Project Area



## 1.3 Background

The complexity of the ocean environment and operations therein has previously encouraged the use of innovative systems to understand maritime dynamics and activity. Ocean-sensing systems now in operation off southern California are associated with those of the Southern California Coastal Ocean Observing System (www.sccoos.org/about/technologies/) and include the use of shore-based high frequency radar to measure the speed and direction of surface currents; coastal meteorological stations; automated shore stations with a variety of sensors attached to piers; moorings of fixed buoys that carry packaged sensors spaced throughout the water column; boat-based programs sampling physical, chemical, and biological properties; and gliders – autonomous underwater vehicles programmed to sample specific areas and depths of the ocean with automated sensors. Other ocean-sensing systems include: Argo (www.argo.ucsd.edu), a global network of widely dispersed, freely drifting floats programmed to descend and measure temperature, salinity, and currents in different layers of the ocean to better understand mechanisms behind global ocean phenomena such as El Niño; and the National Oceanic and Atmospheric Administration (NOAA) Global Drifter Program, comprising over 25,000 surface drifters worldwide, measuring ocean currents, sea surface temperatures, and barometric pressure (www.aoml.noaa.gov/phod/gdp/index.php). Each of these programs is limited in spatial resolution, geographic range, and type of data collected; therefore, they cannot provide the inputs necessary to conduct the data analytics that would enable high-resolution, near real-time characterization of the maritime environment for a specific region.

The Ocean of Things program is a unique approach, fielding a large number of low-cost floats at a relatively high spatial resolution and high rate of real-time data acquisition. Ocean of Things provides opportunities for affordable, integrated ocean sensing and a high-resolution understanding of the dynamics of ocean variables over fairly large scales in regions of interest. Improved maritime analysis provides a more detailed understanding of the natural and human elements of the ocean environment, allowing public agencies to better manage the resources and uses they are responsible for, and enabling the U.S. military to operate more effectively in U.S. territorial waters and on the high seas.

## 1.4 Purpose of and Need for the Proposed Action

The purpose of the Ocean of Things program is to advance the Navy's data collection in the area of meteorology, oceanography, and sensing by developing a cost-effective, low-environmental impact program to characterize an oceanographic region by collecting and analyzing environmental and anthropogenic activity data at a scale and resolution that is currently not available. The Proposed Action is needed to fill a gap in maritime situational awareness by providing a regional, multivariate, high-resolution, real-time picture from a distributed sensor network on the ocean. The primary user for Ocean of Things data would initially be the Navy, but data could also be used by other federal and state agencies and research institutions for purposes such as weather forecasting and calibrating ocean circulation models, monitoring vessel traffic, and in the management of marine protected areas.

EO 13840, *Ocean Policy To Advance the Economic, Security, and Environmental Interests of the United States* (June 19, 2018) includes the goal to improve "…public access to marine data and information, efficient interagency coordination on ocean-related matters, and engagement with marine industries, the science and technology community, and other ocean stakeholders." The Ocean of Things program directly addresses this requirement by providing new, cutting edge ocean technologies and public access to the unique ocean information that will be collected by the Ocean of Things floats at higher spatial resolution than currently exists. Further, the Ocean of Things program directly addresses the requirement to “modernize the acquisition, distribution, and use of the best available ocean-related science and knowledge” by hosting and distributing this information to marine stakeholders (research institutions and government agencies) through modern cloud computing services.

The goal of Phase 1a is to use a limited number of floats (up to 1,000) in a bounded area to demonstrate: (1) float performance of three float designs over a defined duration and (2) use of cloud analytics to characterize a well-defined area. The Phase 1a Study Area would consist of predominantly deep, offshore waters, where potential impacts to coastal, shallow water, and fisheries resources would be minimized, while still overlapping areas with sufficient opportunities to detect maritime activity. A key feature of the Phase 1a Study Area is the placement of mock islands, which are virtual islands created to demonstrate geofence performance around isolated land masses. Scuttle performance around mock islands would be used to support potential future deployments near actual islands. Phase 1a would provide information on float performance - their longevity, drift patterns, data collection and transmittal, and successful programmed scuttling at the boundaries of the geofence. Success in Phase 1a is a precondition to conducting Phases 1b and 2, which would characterize larger Study Areas using greater numbers of floats over longer periods of time.

## 1.5 Coordination/Consultation History

Relevant comments and responses to this EFHA will be provided in the administrative record of the Ocean of Things Program EA/OEA.

# 2 Proposed Action and Alternatives

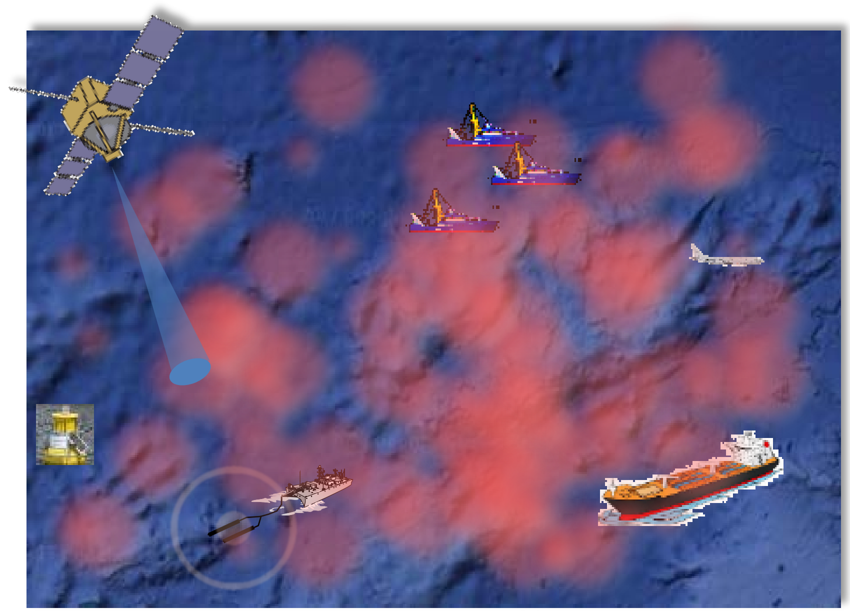
## 2.1 Proposed Action

The Ocean of Things program would provide environmental sensing and operational surveillance missions by distributing small, cost-effective floats with a combination of environmental and mission sensors, and subsequently analyzing that data in near real-time. The Ocean of Things program would be phased as described in Section 1.1, *Ocean of Things Program Overview*. This EFHA only considers implementation of Phase 1a. Phase 1a would consist of deployment of up to 1,000 small floats of three different designs (approximately 333 floats of each type). The floats would drift for up to one month over a limited Study Area in the Pacific Ocean off southern California and Baja California, beyond U.S. and Mexican territorial seas (12 nautical miles or 22 kilometers), prior to scuttling near the boundaries of the geofence; under loss of GPS/communications or low battery power conditions; or at the end of the test period (Figure 2-1). Each of the three float designs would progress through test phases independently; therefore, one-month deployments of each type of float may or may not be concurrent.

### 2.1.1 Maritime Characterization through Cloud-based Data Analytics

The Ocean of Things program is focused on innovative methods for obtaining and analyzing high-resolution maritime and environmental data to enable characterization of the marine environment and tracking of maritime activity. A primary technical objective of the program would be to develop edge-processing methods (i.e., optimizing the floats' onboard computing system for real-time analysis and data discovery objectives) to identify and report the essential information from maritime events within a float's communication and energy constraints. The Ocean of Things program would also investigate the selection of sensors and sampling rates to maximize system performance.

Each float would characterize the physical environment through periodic sampling of local ocean properties, while also reporting nearby maritime events (e.g., vessel presence and activity). Examples of physical environment characterization include, but are not limited to, sea surface/air temperature, ambient noise, wind speed, wave dynamics, and float motion. Examples of activity characterization include the generation of vessel tracks, multi-spectral vessel signatures, vessel behavior, and hydrocarbon detection.



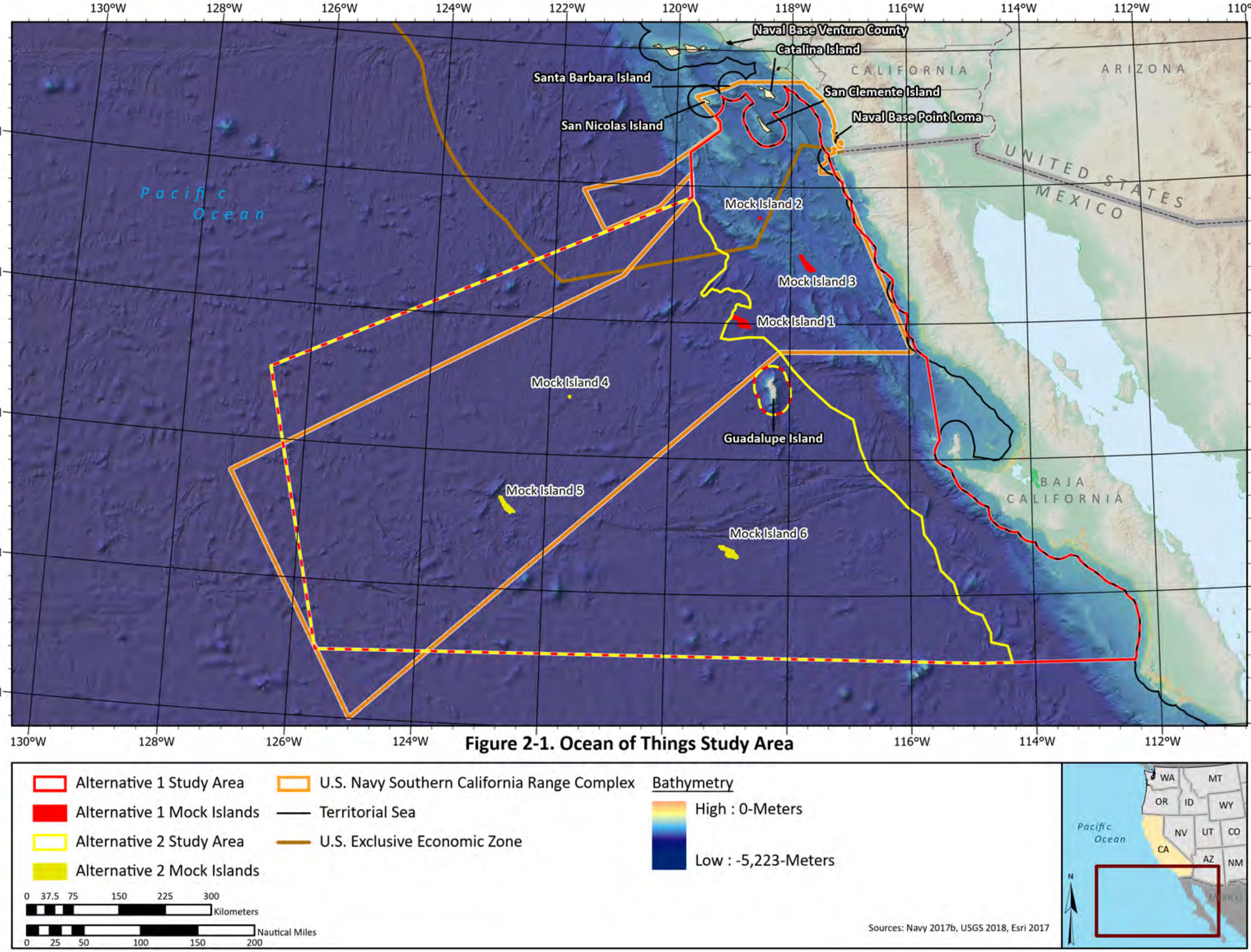



Figure 2-1. Ocean of Things Study Area

To enable timely characterization of activity and the regional environment, data would be collected from each of the floats via satellite network service and managed by NIWC Pacific. Floats would transmit data to the cloud (and receive commands) via the Iridium satellite constellation using Short Burst Data transmission. The Iridium system consists of 66 low earth orbit satellites licensed by the Federal Communications Commission to provide data transmission within an L-band frequency range of 1616 to 1626.5 megahertz. Iridium requirements prevent unacceptable interference to other users of those frequencies, and Iridium reviews and certifies applications for new users, such as Ocean of Things, on that basis.

Floats would report environmental data (e.g., ocean temperature, sea state, location) at programmed intervals. The transmitted data would contain sufficient information for application of advanced processing techniques (e.g., filtering, clustering, and machine learning). Analysts would utilize techniques to process these data to develop vessel tracks, characterize vessel behaviors, and identify new signatures and signal associations in the collected data. Finally, the Ocean of Things program would research methods to visualize coverage, predict performance, and optimize data collection from individual floats within a large field of floats.

### 2.1.2 Float Design and Materials

A primary goal of the Ocean of Things program is to minimize the footprint of each float. Because the floats would be too small and dispersed too widely to be recovered, each float would be scuttled (sink to the ocean bottom) by the end of the test period. Because floats would be non-recoverable, they were carefully designed to mitigate impacts to the environment by making use of innovative materials, minimizing the use of plastics, and staying within a small overall volume (approximately 0.36 cubic foot per float body [11 liters]). Based on DARPA review of the initial proposed designs, the use of plastics in the floats was reduced by approximately 90 percent, with only 0.1 to 0.3 lb of plastic used in each float.

The types of materials would vary by float type and design as discussed below. Materials and components were selected to ultimately achieve a float persistence of 12 months. Floats would contain standard environmental sensing instrumentation in addition to mission-specific instrumentation. Float components would remain unclassified and commercially available. The floats would have the flexibility to accommodate various float sensors and payloads with minimal redesign.

Batteries have metallic (steel, copper, and/or aluminum) jackets and are encased in polypropylene battery packs. Battery types include the following, with components as listed below.

- Alkaline: manganese dioxide (cathode), potassium hydroxide (electrolyte), and zinc dioxide (anode)
- Lithium-ion (rechargeable): lithium cobalt dioxide (cathode), organic solvents and lithium hexafluorophosphate (electrolyte), and graphite (anode)
- Lithium iron phosphate (rechargeable): lithium iron phosphate (cathode), organic solvent and lithium perchlorate (electrolyte), and graphite (anode)

Floats would have a suite of sensors and instrumentation, potentially including any of the following:

- Camera
- Hydrophone (passive)
- Temperature sensor
- Pressure sensor
- Humidity sensor

- Hydrocarbon sensor
- Barometric pressure
- Solar intensity
- 3-axis accelerometer
- Compass
- Microphone
- Radio frequency receiver
- Salinity sensor
- pH sensor
- Global positioning system receiver

The combination of sensors can vary within any float design. All floats would have associated circuit boards and an Iridium 9602/9603 Short Burst Data modem for 2-way communication.

The Ocean of Things program has selected three teams (Numurus, Areté, and PARC) to design and manufacture floats based on program specifications outlined by DARPA. The floats would be assembled by the selected teams at their facilities, then delivered to the Navy for deployment. No environmental analysis is necessary for the use of these facilities because they are routinely used for similar purposes (i.e., to hold and service oceanographic instruments).

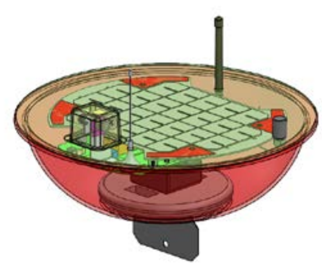
Numurus, Areté, and PARC will each produce a third of the floats for Phase 1a. Of the up to 1,000 floats, there would be three sub-types for each of the three designs with different instrumentation housed in the same primary float structure. Thus, there will be a total of nine types of floats demonstrated, from three general float designs. The materials and designs for the specific Phase 1a floats are provided in Table 2-1.

### 2.1.3 Deployment and Operation of Floats

In Phase 1a, the deployment of up to 1,000 floats in the waters south and southwest of San Clemente Island is designed to investigate float performance and maritime characterization capabilities over a one month period. The performance data obtained during Phase 1a would inform further system development and potential future expanded test phases.

Floats would be transported by the marine vessel (M/V) Diane G or a similar vessel from Naval Base Point Loma (NBPL) and released in a regular pattern within the deployment area, which is predominantly south and southwest of San Clemente Island, but allows for the possibility of drifting freely within the geofence boundaries of the Study Area to the north and east (Figure 2-1). Prior to deployment, a Local Notice to Mariners would be published describing the nature of the activity. The specific location where floats would be initially deployed within the Study Area would be informed by current patterns at that time and the experience of the Navy's oceanographers.

### Table 2-1 Materials and Design Summary for Phase 1a Floats

| ***Component*** | ***Numurus*** | ***Areté*** | ***PARC*** |
|---|---|---|---|
| Outer Case | Soy wax coated cardboard tube and endcap with aluminum base | Aluminum (1.61 pounds) with wood solar panel arms | Glass and stainless steel (0.8 pound) |
| Battery | Alkaline | Rechargeable lithium iron phosphate (1.47 pounds) | Rechargeable lithium-ion cells (1 pound) and alkaline 9-volt cells (0.21 pound) |
| Solar panel | None | Crystalline silicon on FR4 substrate with encapsulant (ethelyne vinyl acetate) and protecting layer (ethylene tetrafluoroethylene) | Crystalline silicon on FR4 substrate with encapsulant (ethelyne vinyl acetate) and protecting layer (ethylene tetrafluoroethylene) |
| Electronics | Small quantities (less than 0.5 pounds) of metals (iron, copper, silver, gold) | Small quantities (less than 0.5 pounds) of metals (iron, copper, silver, gold) | Small quantities (less than 0.5 pounds) of metals (iron, copper, silver, gold) |
| Suspended Attachments | Cotton drag cord, 80 inches long (less than 200 pound breaking strength) and steel weight | None | None |
| Modem | Iridium modem | Iridium modem | Iridium modem |
| Other | Miscellaneous small plastic components (0.3 pound), steel | Miscellaneous small plastic components (0.1 pound), cardboard | Camera module in injection molded plastic; miscellaneous small plastic components (0.1 pound); keel and camera stand made of aluminum; iron weight |
| Size | 5-inch diameter tube by 18 inches long | 5-inch diameter tube by 18 inches long (in folded state) | Half dome shape that is 16.5 inches in diameter and 4.85 inches deep |
| Weight | 13.5 pounds | 7.2 pounds | 17 pounds |
| Scuttle Method | Case fills with water | Case fills with water | A small glass window on the bottom and top of the case breaks; case fills with water |
| Packing Material | Cardboard that would be recycled | Cardboard that would be recycled | Cardboard that would be recycled |
| Design |  |  |  |

During Phase 1a deployment, a float of each design type would be deployed approximately every two minutes from the slowly moving vessel, with an initial spacing of approximately 150-200 meters between floats. Floats are expected to spread out over time, although they could also move closer together depending on currents (D'Asaro et al., 2018). Although the float spacing would vary over time, the spacing is expected to allow for observation of oceanic submesoscale structures (on the order of 1-10 kilometer [km] horizontal, lasting for hours to days). Submesoscale processes are the eddies and similar interactions between currents and other bodies of water that occur at dimensions of less than 100 km across. These often-chaotic energetic processes affect upper ocean dynamics, thermodynamics, and biogeochemistry. Submesoscale structures are increasingly recognized as important dynamical features, previously overlooked due to difficulties in observing them (these structures are generally too small for observation via satellite remote sensing or ship-based surveys) (McWilliams 2016).

A majority of the floats are expected to drift southward, moving with the California Current and potentially reaching the southern boundary of the Study Area within the one-month period (Figure 2-1). Floats could also drift eastward, and then northerly in the California Countercurrent. The Phase 1a Study Area overlaps the Navy's Southern California Range Complex and would provide fairly detailed resolution of surface drift patterns applicable to objects as well as marine biota within this area of interest. Floats would be allowed to drift freely until one of the following scuttling criteria is triggered: reaching a geofence; battery power is low; communication or GPS location is lost for an extended period; end of the one-month test period; or on command via Iridium communication. The floats would be programmed to scuttle at the boundaries of the Study Area, at the mock islands, or seaward of 12 nautical miles of Guadalupe Island (Figure 2-1). Mock islands are virtual islands created to demonstrate geofence performance around isolated land masses. Scuttle performance around mock islands would be used to support potential future deployments near actual islands. An additional scuttle criteria is based on isolation in circumstances that continued data gathering from an isolated float would not serve the purpose of the program.

The Navy independently tested and demonstrated the reliability of the geofence and scuttling capability of the float types to be deployed in this Proposed Action. These tests consisted of lab testing; controlled, tethered testing; and monitored drift testing near San Clemente Island. The in-water tests of a small number of floats were conducted under the HSTT EIS/OEIS (Navy 2018a).

In the unlikely event that a float fails to scuttle as designed and washes ashore, an effort would be made to recover the float. Floats would be labeled to identify that they are part of a DARPA ocean research project and bar coded with points of contact to facilitate returning the float to DARPA. Labels would also provide a brief description of the float and the sensors on-board and identify any potential hazards (potential hazards are discussed in Section 3.6, *Public Health and Safety*). Should the float be picked-up while at-sea the label would provide instructions for returning the float to the ocean.

### 2.1.4 Data Sharing

Environmental data would be available via a public facing website, subject to security requirements, to other federal, state, and local government agencies; academic and other scientific researchers; and commercial organizations. A goal of the collected data is to improve the accuracy and resolution of ocean current modeling through the Ocean of Things program's real-time, fine resolution data and characterization of the marine environment that cannot be achieved through existing technologies. The Ocean of Things program would provide improved accuracy that can potentially improve weather predictions, traffic patterns, traffic efficiency, and marine life protections. The availability of these data also enables analysis by multiple organizations to improve information or processes important to those organizations unrelated to the Ocean of Things program.

## 2.2 Alternative Selection Criteria

NEPA's implementing regulations provide guidance on the consideration of alternatives to a federally Proposed Action and require rigorous exploration and objective evaluation of reasonable alternatives. Only those alternatives determined to be reasonable and to meet the purpose and need require detailed analysis. Potential alternatives that meet the purpose and need were evaluated against the following selection criteria:

- Location that provides a data-rich natural and human environment in proximity to naval facilities for logistics support
- Location with infrequent extreme conditions, such as hurricanes, enabling the persistence of a high percentage of floats to provide broad-scale, high resolution data for the duration of the test periods
- Ability to collect, transfer, and analyze real-time marine data
- Study design that provides relatively high resolution, fine-scale sampling of the marine environment over a broad area
- Study design that minimizes impacts to marine mammals, fishes, sea turtles, habitats, and water quality

## 2.3 Alternative 1 (Preferred Alternative)

Under Alternative 1, up to 1,000 floats would be initially deployed in the Navy's Southern California Range Complex and allowed to drift for one month, or until they approach a geofence where they would scuttle seaward of 12 nautical miles of any shoreline, at the boundaries of the Study Area, or at the mock islands (Figure 2-1). Automatic float scuttling would occur if any of these conditions are met or if floats lose critical capabilities (e.g., GPS or communications) for an extended period. Most of the Alternative 1 Study Area is outside of the U.S. EEZ, on the global commons of the high seas or overlapping the Mexico EEZ.

Under Alternative 1, floats would drift through areas with higher levels of maritime and military activity, providing increased opportunities to obtain data to meet the goals of the Ocean of Things program. In addition, the surface currents and environmental conditions would be more complex across the Southern California Bight (SCB), allowing for improvements in data analytics and regional characterization. The size of the area would allow for both fine scale and large scale characterization of oceanographic phenomena. Lastly, vessel transit time required to implement Phase 1a would be reduced compared to more remote (i.e., farther off shore) deployment areas.

Most floats are expected to drift southward until reaching the southern boundary of the Study Area and are not expected to reach the western boundary in the one-month timeframe (Figure 2-1). A southern geofence was defined to ensure that a large number of floats would be operational (i.e., not scuttled) for the full one-month test period. Although available surface drift modeling predicts widely varying extents of float travel using several years of historical surface data, in general, a large number of floats are predicted to remain north of the selected southern geofence boundary of 25 degrees North latitude. A small fraction would be expected to approach the coast (either mainland or island) and would scuttle seaward of 12 nautical miles of any shoreline or along the mock island boundaries.

Existing surface drift models and available contemporaneous oceanographic data have been used to inform Phase 1a deployment patterns to maximize data collection while minimizing loss of floats through scuttling. Drift patterns of floats in Phase 1a would further inform future deployments in Phase 1b and Phase 2.

# 3 Affected Environment

Descriptions of marine biological resources, sediments, and water quality in the Study Area will appear in detail in the Ocean of Things EA/OEA (see the EA/OEA Sections 3.3 and 3.4). The following descriptions of existing conditions in the Study Area is abridged and tailored to EFH and managed species.

The Study Area for the proposed Ocean of Things Program Phase 1a includes only open ocean waters of the Pacific Ocean offshore of southern California and Baja California. Floats would be deployed offshore and allowed to drift freely until one of the following scuttling criteria is triggered: reaching a geofence (Figure 2-1); battery power is low; communication or GPS location is lost; end of the one-month test period; or on command via Iridium communication. Automatic float scuttling would occur if any of these conditions are met. Most of the Alternative 1 Study Area is outside of the U.S. EEZ, on the global commons of the high seas or overlapping the Mexico EEZ.

## 3.1 Marine Water Column Habitat

Water column habitat in the Study Area extends from the continental shelf to the open ocean and deep sea bottom. The Southern California Bight (SCB) is influenced by two major oceanic currents: the southward flowing, cold-water California Current and the northward flowing, warm-water California Countercurrent. These currents mix in the SCB and strongly influence patterns of ocean water circulation and temperatures along the Southern California coast and the Channel Islands (Richter 2004). The resulting gyres and eddies affect the distribution of organisms leading to the presence of both cold and warm temperature species, which thrive in the transition zones and overlap in their distributions. An upwelling current in the SCB occurs from February or March through August (Dong et al. 2009). High nutrient levels combined with increasing day length and light intensity produce exceptionally high primary production that supports large numbers of fish, shellfish, and other marine life.

Additional information about water column habitat in the Study Area will be detailed in the EA/OEA Sections 3.3 and 3.4, and water quality in Table 3.4-1.

## 3.2 Marine Seafloor Habitat

Habitats on the seafloor are primarily classified on the basis of substrate as rocky reefs, hard bottom, soft bottom, or mixed. Figure 3-1 shows the distribution of these substrate categories throughout the Study Area. Soft bottom is the dominant habitat of the shelf and upper slope, and comprises more than 50% of the California shelf area (Figure 3-1; Allen and Cross 2006). Habitats on the seafloor are also classified on the basis of the dominant organisms, such as seagrass, kelp, deep sea corals, sponges, and bivalves. Figure 3-2 shows the distribution of deep-sea corals, sponges, and rocky reefs, and Figure 3-3 shows the approximate distribution of kelp beds throughout the Study Area. Best available data are shown in Figures 3-2 and 3-3, but note that data are not available for all of the Study Area, particularly outside the U.S. EEZ, and data are not necessarily comprehensive within the U.S. EEZ. Kelp bed and other nearshore habitats have a higher diversity and abundance of fish species than most other California seafloor habitats, and nearly all of this habitat is excluded from the Study Area (Figure 1-1, Figure 2-1, Figure 3-3) (Stephens et al. 2006).

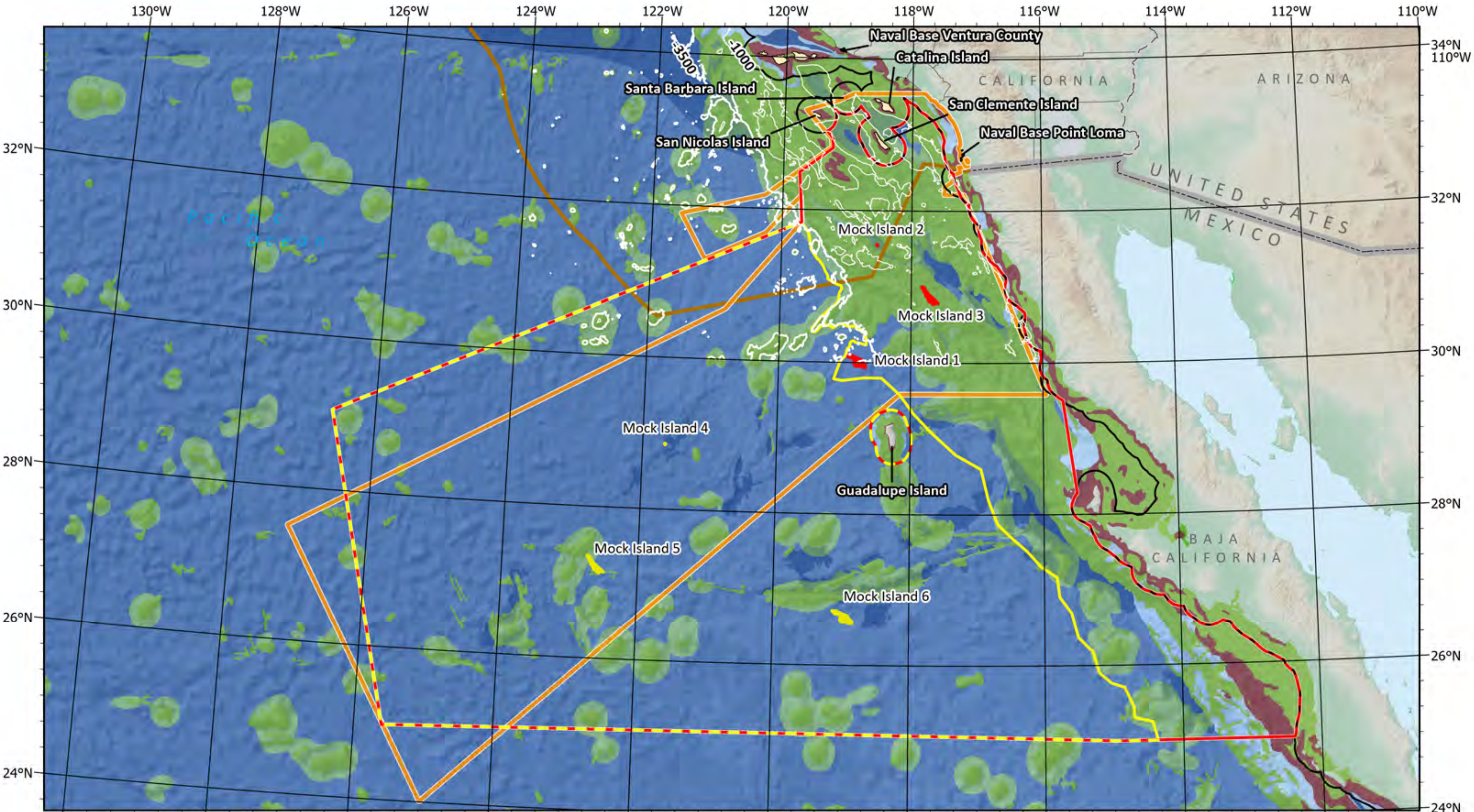



**Figure 3-1. Substrate and Bathymetry**

Alternative 1 Study Area
Alternative 1 Mock Islands
Alternative 2 Study Area
Alternative 2 Mock Islands
U.S. Navy Southern California Range Complex
Territorial Sea
U.S. Exclusive Economic Zone

Seabed Substrate*
Hard
Intermediate
Soft

0 37.5 75 150 225 300 Kilometers
0 25 50 100 150 200 Nautical Miles

*Note: Seabed substrate attributes (hard/intermediate/soft) were applied to the Harris et al (2014) BlueHabitat seafloor classifications by M Lybolt (2 May 2019), supplemented by classifications in IHO (2008) and Divins (2003). Depth contours in meters.

Sources: GRID-Arendal 2014, Navy 2004, NOAA 2018, Esri 2017

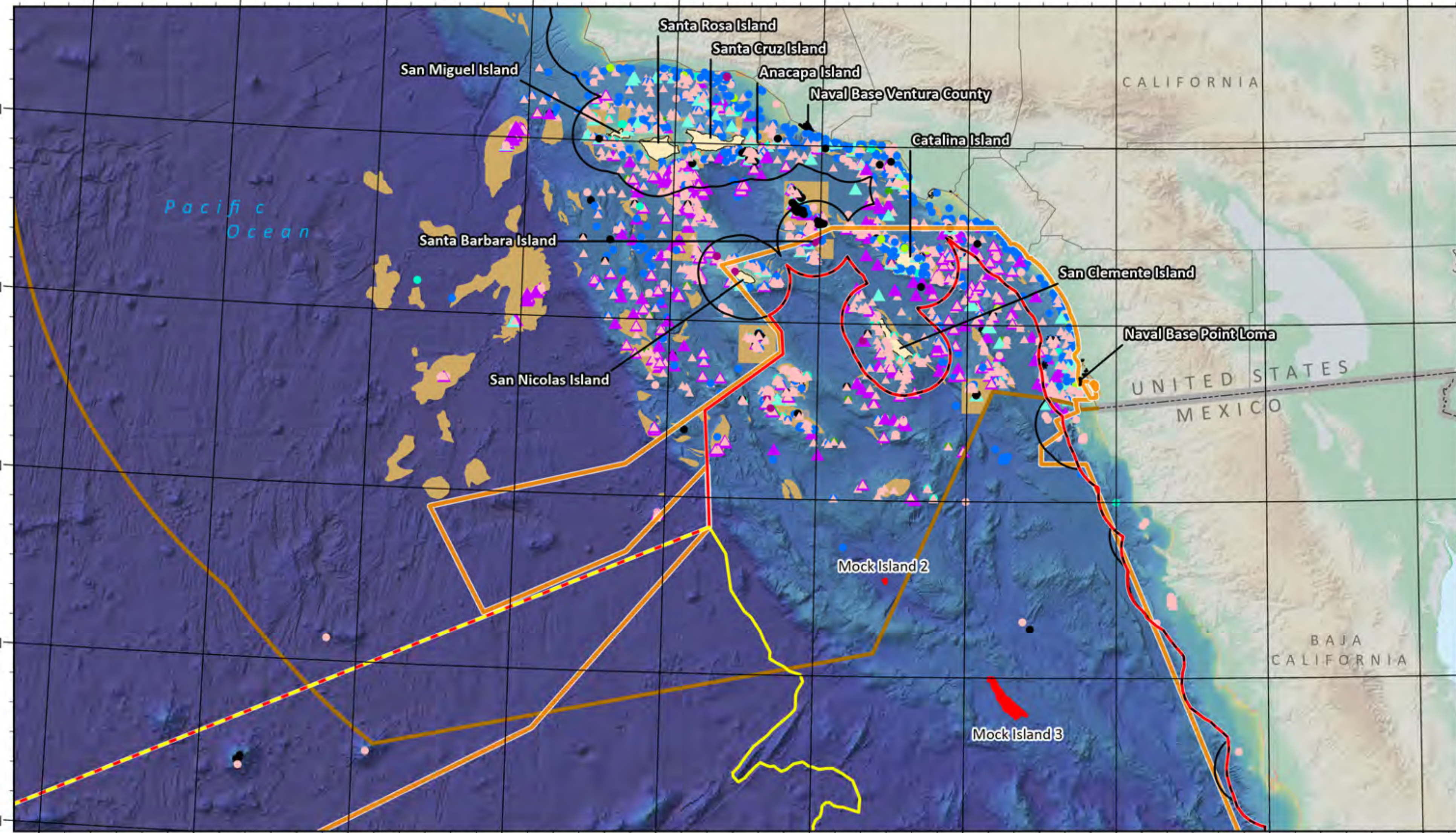
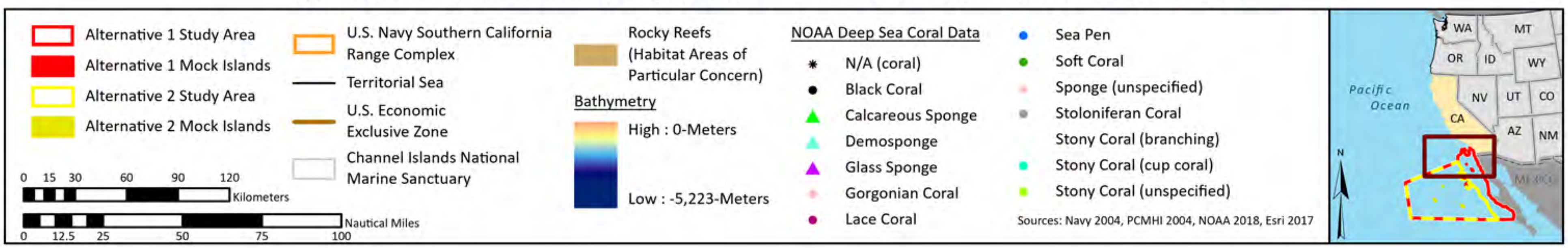



Figure 3-2. Deep Sea Corals, Sponges, and Rocky Reefs in the Vicinity of the Proposed Action



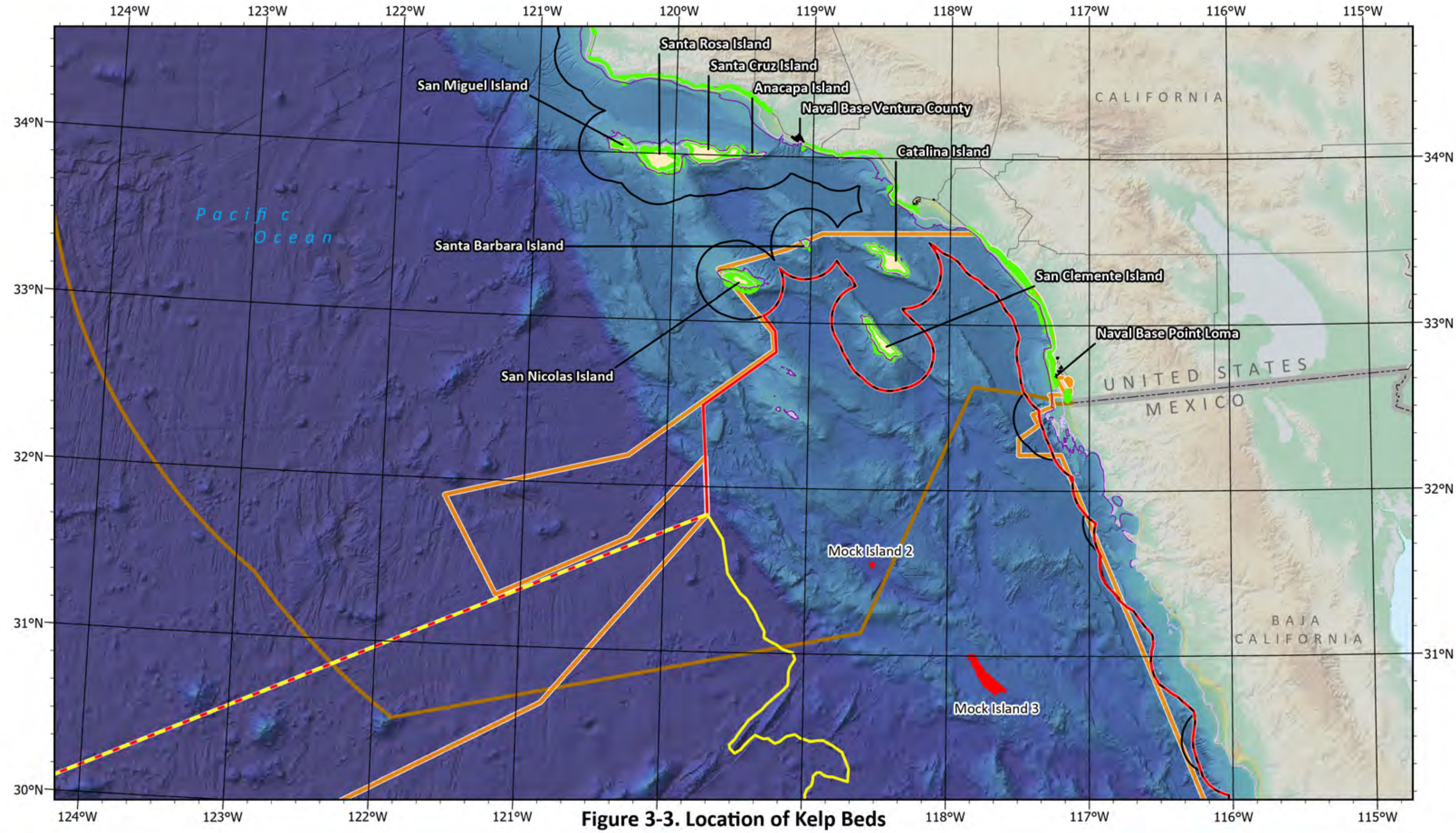
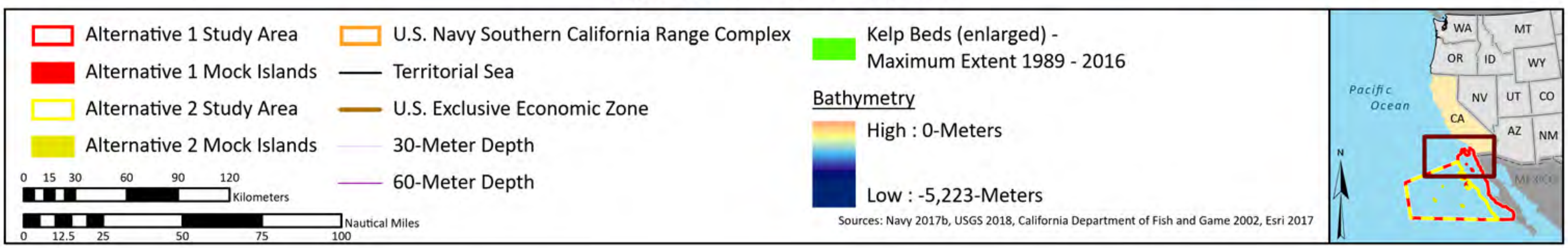



Figure 3-3. Location of Kelp Beds



Kelp, seagrass, and estuarine habitats are nearshore resources that do not occur in the Study Area. Floats approaching the Study Area boundary would be scuttled well before entering adjacent habitats. It is possible that a float would fail to scuttle, and it is possible that the failed float could enter habitats within 12 nautical miles of the shoreline. Potential effects to kelp, seagrass, or estuarine habitats are not discussed in detail because measures would be implemented to minimize potential for any floats to travel beyond the study area boundary (see Section 2.1.3).

Marine invertebrates can occupy habitat, indicate the dominant habitat type, and literally create the habitat. Typical benthic invertebrates include sea anemones, sponges, corals, sea stars, sea urchins, worms, bivalves, crabs, and many more. It is estimated that more than 5,000 marine invertebrate species can be found in the SCB (Dailey et al. 1993; Schiff et al. 2016). There is increasing research into the species diversity, ecological importance (as biogenic EFH), and vulnerabilities of coral and sponge communities in deep-water (Hourigan et al. 2017). These communities occur predominantly on rocky substrate and consist of sessile and relatively brittle marine invertebrates that are susceptible to injury from physical contact (e.g., upright and/or branching forms of deep-water corals or glass sponges) communities (Figure 3-2) (Clarke et al. 2017; NOAA Fisheries 2018a).

No adult life stages of managed marine invertebrate occur in the Study Area (i.e., Olympia oysters, Pacific razor clams, gaper clams, Washington clams, littleneck clams, blue mussels) (Dugan et al. 2000; Chess and Hobson 1997; Kalvass 2001).

## 3.3 Marine Fishes

Fish are vital components of the marine ecosystem and have great ecological and economic benefits. Of the 519 recognized California marine fish species, there are at least 481 species within the greater SCB south of Point Conception (Horn 1980; Cross and Allen 1993; Horn et al. 2006). Geographical distribution is strongly related to temperature and depth preferences of each life stage of a particular fish species (Cross and Allen 1993; Horn et al. 2006). Pelagic fishes inhabit the open water above the bottom for all or part of their life cycle, including coastal pelagic and highly migratory fish species. Some pelagic species (e.g., northern anchovy and Pacific sardine) are extremely important prey for other fish.

Fish assemblages are very diverse in the vicinity of nearshore habitats that support kelp and seagrass, and on nearshore rocky-reef habitats. Yoklavich et al. (2002) identified 95% of all fishes surveyed at water depths of 30 to 100 m as rockfish and 64% of fishes at depths of 100 to 250 m as rockfish. Rockfish diversity also increased in mixed habitat of rock and mud (Yoklavich et al. 2000), and generally increased with water depth (Yoklavich et al. 2002).

Additional information about fishes in the Study Area will be detailed in the EA/OEA Sections 3.3. Background information on select commercially important fish species and Endangered Species Act-listed species in the SCB can be accessed in the Hawaii-Southern California Training and Testing Environmental Impact Statement/Overseas Environmental Impact Statement (Navy 2018).

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# 4 Essential Fish Habitat Designations and Managed Species

The PFMC is responsible for designating EFH for all federally managed species occurring in the coastal and marine waters off the coasts of Washington, Oregon, and California, including Puget Sound. The PFMC designated EFH for these species within the Fishery Management Plans (FMPs) for each of the four fisheries that they manage: Coastal Pelagic Species, Pacific Coast Groundfish, Pacific Coast Salmon, and West Coast Fisheries for Highly Migratory Species, (PFMC 2016a-d). Of these fisheries, three (coastal pelagic species, highly migratory species, and Pacific coast groundfish) contain species for which EFH has been designated within the Study Area (PFMC 2016a-c). Because EFH definitions use a variety of units for depth (e.g., feet, meters, and fathoms), some measurements are not converted to metric to preserve parity with the regulations. Round number approximations are retained as approximations through unit conversions (e.g., "approximately 500 fathoms [900 meters]").

## 4.1 Coastal Pelagic Species

The PFMC Coastal Pelagic Species FMP specifies a management framework for anchovy, sardine, mackerel, market squid, and krill all of which may occur in the Study Area (PFMC 2016a; Table 3-1). Coastal pelagic species are highly transient and their distribution extends throughout southern California at various water depths. Though they are rarely found on or near the seafloor, concentrations of coastal pelagic species fish have been observed in the water column above rocky reef habitats (Lindholm et al. 2016; Pondella et al. 2015). Fish in the coastal pelagic species management unit may occur from the ocean surface to the 1,000 fathom isobath (approximately 1,830 meters deep) including water from shore to approximately 50 to 109 nautical miles offshore (approximately 100 to 300 km). Individuals in the coastal pelagic species management unit could occur in approximately one third of the Phase 1a Alternative 1 Study Area. Coastal Pelagic species are considered most sensitive to fishing, bycatch, lost fishing gear; and to a lesser degree are considered sensitive to loss of habitat, reduction in water and sediment quality, and entrainment through water intakes.

**Table 3-1 EFH Fish Species Known to Occur in the Study Area**

| ***Common Name*** | ***Scientific Name*** |
|---|---|
| **Coastal Pelagic Species** | |
| Northern anchovy | *Engraulis mordax* |
| Pacific sardine | *Sardinops sagax* |
| Pacific (chub) mackerel | *Scomber japonicus* |
| Jack mackerel | *Trachurus symmetricus* |
| Market squid | *Doryteuthis opalescens* |
| Krill | Euphausiidae (8 species) |
| **Highly Migratory Species** | |
| North Pacific albacore | *Thunnus alalunga* |
| Bigeye tuna | *Thunnus obesus* |
| Bluefin tuna | *Thunnus orientalis* |
| Skipjack tuna | *Katsuwonus pelamis* |
| Yellowfin tuna | *Thunnus albacares* |
| Thresher sharks | Family Alophiidae (3 species) |
| Striped marlin | *Tetrapturus audax* |

### Table 3-1 EFH Fish Species Known to Occur in the Study Area

| *Common Name* | *Scientific Name* |
|---|---|
| Shortfin mako shark | *Isurus oxyrinchus* |
| Blue shark | *Prionace glauca* |
| Swordfish | *Xiphias gladius* |
| Dorado | *Coryphaena hippurus* |
| **Groundfish** | |
| Sharks, skates and rays (elasmobranchs) | |
| Skate (big and/or longnose) | *Raja* spp. |
| Leopard shark | *Triakis semifasciata* |
| Spiny dogfish | *Squalus acanthias* |
| **Roundfish** | |
| Sablefish | *Anoplopoma fimbria* |
| Lingcod | *Ophiodon elongatus* |
| Cabezon | *Scorpaenichthys marmoratus* |
| Pacific whiting (hake) | *Merluccius productus* |
| **Rockfish** | |
| Black and yellow rockfish | *Sebastes atrovirens* |
| Blue rockfish | *Sebastes mystinus* |
| Boccacio | *Sebastes paucispinis* |
| Brown rockfish | *Sebastes auriculatus* |
| Copper rockfish | *Sebastes caurinus* |
| Gopher rockfish | *Sebastes carnatus* |
| Grass rockfish | *Sebastes rastrelliger* |
| Kelp rockfish | *Sebastes atrovirens* |
| Olive rockfish | *Sebastes serranoides* |
| Rosy rockfish | *Sebastes rosaceus* |
| Shortbelly rockfish | *Sebastes jordani* |
| Starry rockfish | *Sebastes constellatus* |
| Treefish | *Sebastes serriceps* |
| Vermilion rockfish | *Sebastes miniatus* |
| Widow rockfish | *Sebastes entomelas* |
| **Flatfish** | |
| Dover sole | *Microstomus pacificus* |
| Petrale sole | *Eopsetta jordani* |
| Rex sole | *Glyptocephalus zachirus* |

*Sources:* Navy 2013, 2016; PFMC 2016a,b,c; Pondella et al. 2015.

The definition of EFH for coastal pelagic species finfish is the water column above the thermocline where temperatures range between 10°C to 26°C, based on a thermal range where any life stage may occur. The definition of EFH for all species of krill includes the water column to a depth of 400 meters, and laterally from shore out to the 1,000 fathom isobath (approximately 1,830 meters deep). Coastal pelagic species EFH occurs in about 4% of the Phase 1a Alternative 1 Study Area. Coastal pelagic species

EFH is considered most sensitive to fishing, lost fishing gear; and to a lesser degree is considered sensitive to discharge of offal and slurry from certain at-sea fish processing operations.

## 4.2 Highly Migratory Species

Highly migratory species in the Study Area include albacore, swordfish, dorado, and several species of shark and tuna (PFMC 2016b; Table 3-1). Other highly migratory species may occur in the Study Area as transients. Migratory species transit large distances, often following a food source, and therefore their distributions vary dramatically. These species occur in the water column and are rarely found on or near the seafloor. Species in the Highly Migratory management unit may occur in essentially all of the Study Area. Highly migratory species are considered most sensitive to fishing, bycatch, and lost fishing gear; and to a lesser degree are considered sensitive to prey removal by fishing.

EFH definitions vary for each of the highly migratory management unit species, but generally includes the water column seaward of 100 fathom isobath (approximately 182 meters deep). Highly migratory species EFH includes essentially all of the Study Area. Highly migratory species EFH is considered most sensitive to lost fishing gear; and to a lesser degree is considered sensitive to indirect stresses such as oil/gas exploration/production, pollution, and aquaculture (PFMC 2016b).

## 4.3 Pacific Coast Groundfish

The Pacific Coast Groundfish FMP manages 87 species over a large, ecologically diverse area (PFMC 2016c). The managed groundfish include 4 species of elasmobranchs, 6 species of roundfish, 65 species of rockfish, and 12 species of flatfish; and species in each of these groups are likely to occur in the Study Area (Table 3-1). Groundfish species are primarily associated with rocky reef and hard-bottom habitats composed of boulder, bedrock, cobble, gravel, or mixed gravel/cobble. But groundfish also are found in many other habitat types in the Study Area such as: water column, macrophyte canopies and “drift algae”, unconsolidated mud and sand, mixed sediments (e.g., sand and rocks), and submerged aquatic vegetation. Individuals in the Pacific coast groundfish management unit could occur in approximately one third of the Phase 1a Alternative 1 Study Area. Pacific coast groundfish species are generally considered most sensitive to fishing, bycatch, and lost fishing gear; and to a lesser degree are considered sensitive to prey removal by fishing.

The definitions of EFH vary for each of the Pacific coast groundfish management unit species, but as a whole Pacific coast groundfish EFH is all waters and substrate at depths between 3,500 meters (approximately 11,500 feet) and mean higher high water (MHHW) level - or the upriver extent of saltwater intrusion (PFMC 2016b). Pacific coast groundfish EFH occurs in approximately 3.7% of the Phase 1a Alternative 1 Study Area. Pacific coast groundfish EFH is considered most sensitive to fishing impacts; and to a lesser degree is considered sensitive to pollution, discharge of offal and slurry from certain at-sea fish processing operations, and coastal stresses such as shoreline alteration, oil/gas exploration/production, and point source discharges (PFMC 2016b).

## 4.4 Habitat Areas of Particular Concern

There are four HAPCs designated for Pacific coast groundfish species: (1) seagrass; (2) canopy kelp; (3) rocky reef; and (4) estuarine habitats (PFMC 2016b). Three of these do not occur in the Phase 1a Study Area. The Pacific coast groundfish canopy kelp, seagrass, and estuarine HAPCs are nearshore resources that do not occur in the Phase 1a Study Area. Floats approaching the Phase 1a Study Area boundary would be scuttled well before entering adjacent habitats. It is possible that a float would fail to scuttle, and it is possible that the failed float could enter canopy kelp, seagrass, or estuarine HAPCs. Potential effects to canopy kelp, seagrass, or estuarine HAPCs are not discussed in detail because measures would be implemented to minimize potential for any floats to travel beyond the study area boundary (see Section 2.1.3).

Pacific coast groundfish rocky reef HAPC occurs in the Study Area where hard substrates (bedrock, boulders, cobble, gravel, etc.) and biogenic features associated with hard substrate (deep-water corals and sponges) coincide with depths used by species in the Pacific coast groundfish management unit. Rocky reef HAPC occurs in less than 0.2% of the Phase 1a Alternative 1 Study Area (Table 5-1) and its extent is scattered (Figure 3-2), as mapped by NOAA Fisheries (2018a, b).

No HAPCs have been identified for Coastal Pelagic Species or Highly Migratory Species.

# 5 Assessment of Impacts

The Ocean of Things program would be implemented in several phases as described in Section 1.2, *Ocean of Things Program Overview*. This EFHA only considers implementation of Phase 1a consisting of deployment of up to 1,000 small floats of three different designs (approximately 333 floats of each type), and Phase 1a would further inform future deployments in Phase 1b and Phase 2. All of the Phase 1a Alternative 1 Study Area is outside of U.S. and Mexican territorial seas (12 nautical miles or 22 kilometers), and about 94% is outside of the U.S. EEZ. Most of the Phase 1a Alternative 1 Study Area is on the global commons of the high seas or overlapping the Mexico EEZ (Figure 2-1). The floats would drift for up to one month over a limited Study Area in the Pacific Ocean off southern California and Baja California, beyond U.S. and Mexican territorial seas (12 nautical miles or 22 kilometers), prior to scuttling within the boundaries of the geofence or at the end of the test period.

Of the up to 1,000 Phase 1a floats, there would be three sub-types for each of the three designs with different instrumentation housed in the same primary float structure. The materials and designs for the specific Phase 1a floats are provided in Table 2-1. All floats have circuit boards, an Iridium 9602/9603 Short Burst Data modem for 2-way communication, batteries (alkaline, lithium-ion, lithium iron phosphate), and a suite of sensors and instrumentation. Because floats would be non-recoverable, they were carefully designed to mitigate impacts to the environment by making use of innovative materials, minimizing the use of plastics, and staying within a small overall volume (approximately 0.2 $ft^3$ per float body [5.6 liters]). Since the initial proposed designs, the use of plastics in the floats has been reduced by approximately 90%, with plastic use in each float ranging from only 0.1 to 0.3 lb.

## 5.1 Approach to Analysis

The approximate dimensions of each Phase 1a floats are listed in in Table 2-1. Assuming up to 1,000 floats and approximately 333 of each design, the total volume of all Phase 1a floats would be approximately 280 $ft^3$ (7,927 liters). Their total cross-sectional area when scuttled would be approximately 1,798 square feet (167 square meters). A sub-set of floats would have suspended attachments (Phase 1a floats only suspend ballast) and once scuttled suspended cords are assumed to double the cross-sectional area, adding approximately 133 square feet (12 square meters). The total potential direct footprint of all scuttled Phase 1a floats is approximately 1,931 square feet (179 square meters), representing less than one billionth of the Study Area (Table 5-1).

The ultimate distribution of scuttled floats cannot be reliably estimated; in any case it would probably not be uniform, and could be somewhat clustered as a result of gyres, mesoscale to submesocale eddies, and scuttle boundary locations. Preliminary drift modeling predicts widely varying extents of float travel, but in general, a large number of floats are predicted to remain well south of the US EEZ and outside of EFH. To examine a range of potential impacts to substrates, two scenarios are analyzed: (1) **Worst-Case Impacts**, in which the affected substrate type(s) would receive 100% of the scuttled floats; and (2) **Proportional Impacts**, in which the area of affected substrate is a function of the area of seafloor type(s) assuming a random distribution of scuttled floats.

## Table 5-1 Sizes of Study Area Features Relative to Footprints

| *Features of the proposed Study Area* | *Area ($km^2$) or Perimeter (km)* | *Percent of feature relative to the Study Area (e.g. the EEZ is 6.3% of the Study Area)* | *179 $m^2$ of float coverage relative to the feature [4]* |
|---|---|---|---|
| Size of Study Area | 765,560 $km^2$ | n/a | 23 billionths of 1% |
| Size of US EEZ within Study Area | 48,240 $km^2$ | 6.3% | 372 billionths of 1% |
| Size of continental shelf[1] within Study Area | 1,500 $km^2$ | 0.1959% | 12 millionths of 1% |
| Size of “hard or intermediate seafloor”[2] within Study Area | 120,950 $km^2$ | 15.8% | 148 billionths of 1% |
| Size of “hard or intermediate seafloor”[2] within Study Area US EEZ | 28,040 $km^2$ | 58.1% | 640 billionths of 1% |
| Size of “soft seafloor”[2] within Study Area | 644,610 $km^2$ | 84.2% | 28 billionths of 1% |
| Size of “soft seafloor”[2] within Study Area US EEZ | 20,200 $km^2$ | 41.9% | 888 billionths of 1% |
| Size of Groundfish EFH within Study Area | 28,040 $km^2$ | 3.7% | 640 billionths of 1% |
| Size of Rocky Reef HAPC within the Study Area | 1,000 $km^2$ | 0.1306% | 18 millionths of 1% |
| Perimeter of Study Area (total geofence) | 4,350 km | n/a | 4 thousandths of 1% |
| Study Area perimeter against the 12NM geofence (22.22 km) | 1,659 km | 38.1% | 11 thousandths of 1% |
| Geofence along groundfish EFH | 624 km | 14.3% | 29 thousandths of 1% |
| Smallest distance between Study Area geofence and any kelp[3] | 20 km | n/a | n/a |
| **Maximum footprint of scuttled floats[4]** | **0.000130 $km^2$** | **n/a** | **23 billionths of 1%** |

Notes: All values are approximations that may change by a few percent as different precision standards are used.

[1] Continental Shelf is shallower than 200 meters using BlueHabitats definition (Harris et al. 2014).

[2] Seabed substrate attributes (hard/intermediate/soft) were applied to the Harris et al (2014) BlueHabitat seafloor classifications by M Lybolt (2 May 2019), supplemented by classifications in International Hydrographic Organization (2008) and Divins (2003).

[3] Kelp mapping as shown on Figure 3-3.

[4] Assumes the scuttled float footprint occurs as 1 $m^2$ units.

Floats were carefully designed to eliminate or minimize their potential threats to the environment. Phase 1a floats on (in) the water column do not present reasonable threats to EFH or managed species and these potential impacts are not analyzed: physical strike, ingestion, entanglement, artificial lighting, acoustic, water quality, and chemical risks. Phase 1a floats scuttled on the seafloor are analyzed for potential impacts by physical contact and addition of chemicals. Phase 1a floats scuttled on the seafloor are not analyzed for potential impacts by physical strike, ingestion, entanglement, artificial lighting, or acoustics, because there is no reasonable mechanism for impact to EFH or managed species.

Fish entanglement in a suspended line is discountable because these structures would be highly visible, slowly drifting with the current, and without loose ends or loops that could entangle a fish. Fish entanglement in parts of a scuttled float is similarly implausible and discountable. Ingestion of floats or components of scuttled floats by fishes is discountable because the floats or components do not resemble food (i.e. fish or invertebrates) in size or texture, and because bottom-feeding organisms are adept at rejecting or processing non-food items without injury.

## 5.2 Impact Assessment Criteria

Under the provisions of the MSFCMA, as reauthorized by the Sustainable Fisheries Act Amendments, federal agencies must consult with NMFS prior to undertaking any actions that may adversely affect EFH. Federal agencies retain the discretion to determine what actions fall within the definition of “adverse affect.” Temporary or minimal impacts, as defined below, are not considered to “adversely affect” EFH. “Temporary impacts” are those that are limited in duration and that allow the particular environment to recover without measurable impact. “Minimal impacts” are those that may result in relatively small changes in the affected environment and insignificant changes in ecological functions, or those that are limited duration and allow the affected area to recover before long term impacts to EFH occur.

## 5.3 Potential Effects on Coastal Pelagic Species EFH

Coastal pelagic species EFH occupies approximately 4% of the Phase 1a Alternative 1 Study Area, and approximately 15% of the Phase 1a geofence (Table 5-1). An implausible worst-case estimate would assume that 100% of Phase 1a floats occupy coastal pelagic species EFH, affecting approximately 1,798 square feet (167 square meters). Reasonably likely proportional footprints would be 7 square meters based on the size of coastal pelagic species EFH, or 27 square meters based on the size of the geofence along coastal pelagic species EFH. If floats were well dispersed there would be less than 1 float per 100 square km. Floats will disperse and coalesce depending on conditions, and as floats coalesce the probability that a ‘group’ of floats would occupy EFH diminishes even further.

The deployment of the floats, their subsequent drifting, and ultimate scuttling would have only momentary interactions with any particular unit of the ocean surface, water column EFH, or managed species. Completely scuttled floats would have no effect because the seafloor is not a component of coastal pelagic species’ EFH. Disturbance and vessel noise associated with float deployment may elicit a temporary behavioral response from fish within sight or hearing distance of the vessel, such as swimming away from the vessel, and no other effects are plausible. Consequences of behavioral response could include momentary disruptions of feeding or other behaviors. Disturbance associated with drifting floats may elicit a temporary behavioral response from fish that are within sight-distance of the float, such as avoidance or attraction to the floating object, and no other effects are plausible. Consequences of attraction could include increased susceptibility to predation and increased feeding efficiency for predators.

Overall, the Ocean of Things Program Phase 1a Alternative 1 would not adversely affect the quality and/or quantity of coastal pelagic species EFH. Potential effects to managed species would be temporary and consequences would be minimal.

## 5.4 Potential Effects on Highly Migratory Species EFH

Potential effects on highly migratory species EFH are not materially different than for coastal pelagic species, the same rationale and conclusions apply (see above).

Overall, the Ocean of Things Program Phase 1a Alternative 1 would not adversely affect the quality and/or quantity of highly migratory species EFH. Potential effects to managed species would be temporary and consequences would be minimal.

## 5.5 Potential Effects on Pacific Coast Groundfish EFH

Pacific coast groundfish EFH occupies approximately 3.7% of the Phase 1a Alternative 1 Study Area, and approximately 14.3% of the Phase 1a geofence (Table 5-1). An implausible worst-case estimate would assume that 100% of Phase 1a floats scuttle onto Pacific coast groundfish EFH, affecting approximately 1,931 square feet (179 square meters). Reasonably likely proportional footprints would be 6.6 square meters based on the size of groundfish EFH, or 25.7 square meters based on the size of the geofence along groundfish EFH. The actual size of the footprint depends on many factors (orientation of the scuttled equipment, float type and status, the nature of the seafloor, etc.), but none of these meaningfully affect the analyses of the total footprint of all scuttled floats.

The deployment of the floats, their subsequent drifting, and descent during scuttling would have only momentary interactions with any particular unit of the ocean surface and water column Pacific coast groundfish EFH. Potential effects on Pacific coast groundfish EFH are not materially different than for coastal pelagic species EFH, and the same rationale and conclusions apply (see above). Because Pacific coast groundfish are generally demersal during most juvenile and adult life stages, any consequences during the 1-month operational phase are considered possible but not plausible.

Seafloor of Pacific coast groundfish EFH will be affected by scuttled floats. The extent, magnitude, and duration of the seafloor effects from scuttled floats would diminish over time because many components are designed to degrade readily. Non-degradable components in scuttled floats would have essentially permanent seafloor effects, and the total footprint of non-degradable components would be approximately one order of magnitude less than the total footprint because floats are designed with a minimum of non-degradable components (worst-case total of approximately 1,931 square feet [179 square meters]). Relatively few float components are essentially non-degradable (e.g, some plastics, glass, $SiO_2$ in electronics, some adhesives). Some small pieces of plastic may float, and these would likely persist in the marine environment with the same trajectory as other as floating debris. Most float components that contain plastic are sufficiently dense to sink to the seafloor. Consequences of non-degradable components would be limited to physical contact because non-degradable components are essentially inert.

Consequences of scuttled floats physically occupying seafloor EFH would be measurable but minimal for two main reasons. First, Pacific coast groundfish EFH is not considered sensitive to debris or non-fishing physical contact with the seafloor (PFMC 2016b). Additionally, a scuttled float is unlikely to settle on the seafloor with enough force to damage biogenic habitat (e.g., sponge, coral, worms, bivalves). Second, magnitude of physically contacting and obstructing approximately 71 - 277 square feet (6.6 - 25.7 square meters) of native seafloor is too small for any meaningful consequence to the quantity or quality of forage and refuge habitat (see 1st paragraph of this Section). Even the implausible worst-case footprint of approximately 1,931 square feet (179 square meters) amounts to less than one billionth of the Pacific coast groundfish EFH in the Study Area (Table 5-1). Scuttled floats could provide attractive refuge for small organisms, but for the same reasons, any potential benefit would be too small for any meaningful consequence.

Consequences of physical- chemical- and bio-degradation of scuttled floats would be temporary or minimal, mainly because the floats are designed to exert minimal physical and chemical risks during degradation. In general, three things happen to materials that come to rest on the ocean floor: (1) they lodge in sediments where there is little or no oxygen and degradation is slowed or inhibited (Ankley 1996), (2) they remain on the ocean floor and react with seawater, or (3) they remain on the ocean floor and become encrusted by marine organisms. As a result, rates of degradation depend on the materials and the conditions in the immediate marine and benthic environment. Scuttled floats that settle onto low-density sediments tend sink into the sediment (self-bury) which slows or inhibit degradation, similar to the fate of most munitions used in marine training and testing (Environmental Sciences Group 2005; Navy 2018).

Degradation of float components on the seafloor will include alkaline or lithium polymer batteries. Alkaline batteries no longer contain lead, have low toxicity, and are expected to have very localized effects on sediment or water quality. Lithium polymer batteries are more stable than other types of batteries and are non-toxic.

Degradation of metals exposed to seawater is called oxidation. Metals begin to oxidize and the outer layer of metal oxide inhibits direct exposure to seawater and slows oxidation rates. The most familiar metal oxide is rust (iron oxide), but many metals may also oxidize into halides, sulfates, and other compounds. Elevated levels of metal oxides in sediments are typically restricted to a small zone around the metal, on the order of centimeters to meters. Highly soluble oxides would be quickly diluted into the overlying water column. But many metal oxides quickly precipitate out of seawater through common series of chemical reactions in the marine environment and settle on the seafloor in solid form.

Consequences of chemicals released during degradation of metals are intensively studied, particularly in the context of munitions and devices expended during military training and testing standards (Environmental Sciences Group 2005; Naval Facilities Engineering Command 1993; Navy 2018). Two relevant studies tested the effects of metals (lead, copper, nickel, silver, and lithium) in similar oceanic-sedimentary contexts as the Ocean of Things (e.g., from sonobuoys, torpedoes, acoustic countermeasures, and targets). Materials in both of these studies would also occur in the various float designs. Both studies found that any metal contaminants were most likely to concentrate on fine-grained particulate matter with no measurable effect on water quality and no exceedance state or federal water quality standards (Environmental Sciences Group 2005; Naval Facilities Engineering Command 1993). The floats are designed to exert minimal chemical risks during degradation, and the initial concentrations of metals in floats is much lower than sonobuoys and torpedoes in the referenced degradation studies. Consequences of chemicals released during degradation of scuttled floats would be minimal, with no measurable effect on water quality and no exceedance state or federal water quality standards.

Pacific coast groundfish rocky reef HAPC could potentially be affected by scuttled floats. Consequences to rocky reef HAPC would be identical to consequences discussed for Pacific coast groundfish EFH, but much smaller magnitude. Rocky reef HAPC occurs in less than 0.2% of the Phase 1a Alternative 1 Study Area (Table 5-1) and its extent is scattered (Figure 3-2). Rocky reef HAPC is such a small fraction of the Study Area that the proportional footprint is fewer than 3 floats out of 10 million scuttling onto rocky reef HAPC. An implausible worst-case estimate would assume that 100% of Phase 1a floats scuttle onto EFH, of which approximately 19.9 square feet (1.9 square meters) could be affected HAPC.

Shallower Pacific coast groundfish EFH within 12 nautical miles of the shore is specifically excluded from the study area and floats would be scuttled well before entering these habitats. It is possible that a float could fail, and the failed float could drift into or through a kelp bed or shallow rocky-reef habitat. Potential effects to EFH within 12 nautical miles of the shore would be identical to effects to any other habitat, but are not discussed in detail because measures would be implemented to minimize potential for any floats to travel beyond the study area boundary (see Section 2.1.3).

Overall, the Ocean of Things Program Alternative 1 would adversely affect the quality and/or quantity of Pacific coast groundfish EFH and the rocky reef HAPC, but consequences would be minimal. Potential effects to managed species would be temporary and consequences would be minimal or temporary.

## 5.6 Conservation Measures

The Navy has carefully designed the Ocean of Things program to avoid and mitigate potential impacts to the marine environment. The most effective measures that have been incorporated into the Proposed Action include:

- The action is testing competing systems with a minimum number of floats needed to evaluate all program goals.
- The floats are designed to exert minimal physical and chemical risks during operation and degradation by including:
  - Minimal use of hazardous or toxic materials and coatings.
  - Use of biodegradable packing materials/floats and negatively buoyant components to extent possible.
  - Reduction of non-degradable components and minimization of the use of plastics.
- The study area has been carefully selected to avoid particularly sensitive habitats and the shoreline, where the potential consequences of any impact are greater.
- Implementation of the geo-fence and floats' scuttling mechanisms has been test and validated to ensure floats do not drift and/or scuttle near or in sensitive habitats and the shoreline.

Additionally, the following general practices would be implemented to minimize potential risks to EFH and managed species:

- The discharge of oil, fuel, or chemicals to the marine environment is prohibited;
- Navy will monitor the program activities and will promptly notify NMFS of any changes to the program or the occurrence of previously unidentified factors.

## 5.7 Conclusion

As described in the above effects analysis, the Navy has determined that the Proposed Action may adversely affect Pacific coast groundfish EFH and the rocky reef HAPC, but effects would be minimal or temporary and localized. The Navy has determined that the Proposed Action would not adversely affect highly migratory or coastal pelagic species EFH or federally managed fish (Table 5-2). The Proposed Action contains adequate measures to avoid effects to EFH and HAPCs. The Ocean of Things program would have little to no negative effects on the quantity and quality of EFH. Benefits of the Proposed Action include improving understanding of the regional offshore ocean environment resulting from environmental and oceanographic data collected through the OOT program, and data-sharing with NOAA.

**Table 5-2 Summary of Potential Impacts to EFH**

| *Resource Area* | *Alternative 1 EFH* | *Alternative 1 Managed Species* |
|---|---|---|
| Coastal pelagic species | Would not adversely affect the quality and/or quantity of coastal pelagic species EFH. | Potential effects to managed species would be temporary and consequences would be minimal. |
| Highly migratory species EFH | Would not adversely affect the quality and/or quantity of highly migratory species EFH. | Potential effects to managed species would be temporary and consequences would be minimal. |
| Pacific coast groundfish EFH | May adversely affect the quality and/or quantity of Pacific coast groundfish EFH, but consequences would be minimal or temporary. | Potential effects to managed species would be temporary and consequences would be minimal. |
| Pacific coast groundfish rocky reef HAPC | May adversely affect the quality and/or quantity of Pacific coast groundfish rocky reef HAPC, but the potential for effect is exceptionally small, and consequences would be minimal or temporary. | Not applicable |

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Enclosure 2. Section 7 Informal Consultation for the At-Sea Testing of the Ocean of Things Program

The United States Navy's Naval Information Warfare Systems Command (NAVWAR) requests informal section 7 consultation for the Navy's proposed at-sea testing for Phase 1a of the Defense Advanced Research Project Agency's (DARPA) Ocean of Things program in the Pacific Ocean offshore of southern California and Baja California.

The Proposed Action is the implementation of Phase 1a of the Ocean of Things program, consisting of the deployment of up to 1,000 small (approximately 0.36 cubic foot per float), non-recoverable freely drifting floats for one month to measure environmental conditions and detect anthropogenic activity. The purpose of the Proposed Action is to develop a cost-effective, low-environmental impact program to characterize an oceanographic region by collecting and analyzing environmental and activity data at a scale and resolution that is currently not available. The Proposed Action is needed to fill a gap in maritime situational awareness by providing a regional, multivariate, high-resolution, real-time picture from a distributed sensor network on the ocean. The Ocean of Things program and the Phase 1a test are further described in the Essential Fish Habitat Assessment (Enclosure 2) to this letter. Enclosure 2 also provides a map of the Action Area for the Phase 1a test.

The testing of the Ocean of Things program is phased to effectively develop, demonstrate, and evaluate this technology. Phase 1a (this consultation) includes up to 1,000 floats of three designs, released for a 1-month period in a limited Study Area. Each subsequent phase would be defined by separate requirements and broadening objectives, which may involve alterations to design, programming, data processing, location, and/or number of floats released as the Ocean of Things program progresses. For example, Phase 1b is intended to release up to 3,350 floats for a 3-month period in an expanded Study Area, and Phase 2 is intended to release of up to 15,000 floats for a 9-month period in an expanded Study Area. Implementation of later phases (Phase 1b and Phase 2) would be conditional on the demonstrated successes of prior phases and are not proposed at this time.

**Table 1 Endangered Species Act-Listed Species Found in Waters off Southern California**

| ***Species Name and ESA Status***[1] | | | ***Presence in Action Area*** |
|---|---|---|---|
| ***Common Name*** | ***Scientific Name***[1] | ***ESA Status*** | |
| White abalone | *Haliotis sorenseni* | Endangered | Tanner and Cortes Banks, only |
| Scalloped hammerhead shark[2] | *Sphyrna lewini* | Endangered | Continental shelf and offshore |
| Steelhead[2] | *Oncorhynchus mykiss* | Endangered | Coastal waters, continental shelf; and less frequently offshore |
| Gulf grouper | *Mycteroperca jordani* | Endangered | Coastal waters to 50 m depths. |
| Giant manta | *Manta birostris* | Threatened | Continental shelf and offshore |
| Oceanic whitetip shark | *Carcharhinus longimanus* | Threatened | Continental shelf and offshore |
| Loggerhead sea turtle | *Caretta caretta* | Endangered | Coastal waters to open ocean |
| Olive ridley turtle | *Lepidochelys olivacea* | Endangered | Coastal waters, continental shelf; and less frequently offshore |

**Table 1 Endangered Species Act-Listed Species Found in Waters off Southern California**

| Species Name and ESA Status[1] | | | Presence in Action Area |
|---|---|---|---|
| ***Common Name*** | ***Scientific Name[1]*** | ***ESA Status*** | |
| Leatherback turtle | *Dermochelys coriacea* | Endangered | Open ocean; occasional coastal waters |
| Pacific green sea turtle | *Chelonia mydas* | Threatened | Coastal waters, bays, and harbors; and transit > 1 km offshore |
| Blue whale | *Balaenoptera musculus* | Endangered | Continental shelf and offshore |
| Fin whale | *Balaenoptera physalus* | Endangered | Continental shelf and offshore |
| Humpback whale[2] | *Megaptera novaeangliae* | Endangered | Continental shelf and offshore |
| North Pacific right whale | *Eubalaena japonica* | Endangered | Not expected to be present in the Study Area |
| Sei whale | *Balaenoptera borealis* | Endangered | Unknown. Likely continental shelf and offshore |
| Sperm whale | *Physeter macrocephalus* | Endangered | Continental shelf and offshore |
| Guadalupe fur seal | *Arctocephalus townsendi* | Threatened | Likely in Mexican coastal waters and elsewhere throughout the Study Area |
| Steller sea lion | *Eumetopias jubatus* | Threatened | Not expected to be present in the Study Area |
| 1 Taxonomy follows Committee on Taxonomy (2016, 2017)<br>2 Scalloped hammerhead Eastern Pacific DPS; Steelhead Southern California Coast DPS; Humpback whale Mexico DPS, Central America DPS | | | |

In brief, sensor floats would contain standard environmental sensing instrumentation and satellite telemetry within a carefully designed minimal footprint making use of innovative materials to mitigate impacts to the environment. Floats would scuttled (sink to the ocean bottom) at low battery, when communication is lost for a prolonged duration, or when they approach a Study Area boundary (geofence). At the end of the one month test period, any floats remaining at the surface would be command scuttled. Assuming up to 1,000 floats and approximately 333 of each design, the total volume of all Phase 1a floats would be approximately 280 $ft^3$ (7,927 liters). Their total cross-sectional area when scuttled would be approximately 1,798 square feet (167 square meters). A sub-set of floats would have suspended ballast, and once scuttled suspended cords are assumed to double the cross-sectional area, adding approximately 133 square feet (12 square meters). The total potential direct footprint of all scuttled Phase 1a floats is approximately 1,931 square feet (179 square meters). Details of the proposed in-water activities are provided in the EFH Assessment (Enclosure 2) that accompanies this analysis.

**Ocean of Things Phase 1a Proposed Action and Study Area**

Release of floats under Phase 1a could occur at any time during the year, depending on when the Navy has validated each float type (three types) and determined it is ready for Phase 1a testing. The three float types, therefore, may be deployed simultaneously or separately, depending on development timeframes.

Marine habitats within 12 nautical miles of the shore are specifically excluded from the study area. Interaction between a float and coastal species is exceptionally unlikely because measures would be implemented to minimize potential for any floats to travel beyond the study area boundary.

The deployment of the floats, their subsequent drifting, and ultimate scuttling would have only momentary interactions with any particular individual or unit of water column habitat. Disturbance and vessel noise during float deployment may elicit a minor temporary behavioral response such as swimming away from the vessel, but would have no other effects on individuals. Vessel operations would follow the Navy's Protective Measures Assessment Protocol. Mitigation Requirements for Vessels:

- Mitigation zones:
  - 500 yd. around whales
  - 200 yd. around other marine mammals (except bow-riding dolphins and pinnipeds hauled out on man-made navigational structures, port structures, and vessels)
  - Within the vicinity of sea turtles
- During the activity:
  - When underway, observe the mitigation zone for marine mammals and sea turtles; if observed, maneuver to maintain distance.
- Additional requirements:
  - If a marine mammal or sea turtle vessel strike occurs, the Navy will follow the established incident reporting procedures.

The possibility that any threatened or endangered individual would ever encounter a float is nearly discountable because of the extremely low density of floats. Floats would initially be deployed at a spacing of approximately 200 m between floats, although floats would ultimately disperse and coalesce depending on conditions. If floats were well dispersed through the Study Area, there would be less than 1 float per 100 square km.

Interaction with drifting floats may elicit a temporary behavioral response from individuals that are within sight-distance of the float, such as avoidance or attraction to the floating object. The potential for bottom-feeding individuals to encounter scuttled floats on the seafloor would be even smaller than potential for encounter at the surface because the majority of floats would be scuttled in water that is far deeper than the foraging areas for bottom-feeding threatened or endangered species (e.g., gray whale and humpback whale) (Hain et al. 1995; Ware et al. 2014).

**Endangered Species Act-Listed Species in the Study Area**

The endangered white abalone (*Haliotis sorenseni*) occurs on rocky bottom in depths of 20-60 m, in extremely low numbers along the mainland coast of Southern California, and at a few offshore islands and banks, including the west side of San Clemente Island and at the Tanner and Cortes Banks (NOAA Fisheries 2018c; Butler et al. 2006). No other ESA-listed marine invertebrate species occur in the Study Area. The endangered black abalone (*Haliotis cracherodii*) occurs within 0.5 miles (1 km) from shore, and extensive surveys found no black abalone at Tanner and Cortez banks (NOAA Fisheries 2018c; Butler et al. 2006). Potential effects to abalone or their habitats are not discussed in detail because measures would be implemented to minimize potential for any floats to travel beyond the Study Area boundary.

The scalloped hammerhead shark is a coastal and semi-oceanic species distributed in temperate and tropical waters (Froese & Pauly, 2016). Scalloped hammerhead sharks are rare in offshore areas of Southern California (Duncan & Holland, 2006; Shane, 2001). Steelhead may occur offshore of the Pacific coast during a portion of the adult stage of their life cycle (Good et al., 2005). Most of the threats to steelhead occur in rivers outside the Study Area. The gulf grouper is found in the subtropical eastern Pacific Ocean and Gulf of California, from La Jolla, California, to Mazatlán, Sinaloa, Mexico (Dennis, 2015). Adults inhabit rocky reefs, seamounts, and kelp beds at depths between 30 and 45 m (Dennis, 2015). Giant manta rays are found along coastlines with regular upwelling including offshore pinnacles and seamounts. They utilize habitat near the ocean surface both inshore and offshore (National Oceanic and Atmospheric Administration, 2016c). The oceanic whitetip shark inhabits pelagic waters throughout the subtropical and tropical Pacific Ocean (National Marine Fisheries Service 2018).

There are no known sea turtle nesting beaches on the west coast of the United States. No part of the Study Area is a concentration area or destination for sea turtles, although sea turtles are frequently sighted around the Channel Islands (Office of National Marine Sanctuaries 2009). Sea turtle abundance in the SCB is greatest during summer-fall months and warm water/El Niño periods (Navy 2017b). A recent study estimated that during 2015 (an El Niño year), 70,000 juvenile and young adult loggerhead sea turtles dispersed northward and offshore from traditional foraging grounds off the Baja California peninsula into the SCB, with many sightings reported off San Diego (Eguchi et al. 2018). Background information on these species as they occur in the project area is provided in the HSTT EIS/OEIS (Navy 2017b, 2018).

Marine mammals in the Study Area include cetaceans, pinnipeds, and 1 sea otter (species (Navy 2009, 2017a, 2017b). The sea otter is under jurisdiction of the U.S. Fish and Wildlife Service, and not considered here. Within the cetaceans, “Odontocetes” include toothed whales (and dolphins, porpoises), and “Mysticetes” refers to baleen whales. The sperm whale is the only ESA-listed Odontocete in the Study Area. Mysticetes are universally large whales (more than 15 feet as adults) that use baleen to feed, instead of teeth. Detailed reviews of mysticetes and odontocetes feeding strategies, populations, and distribution patterns can be found in Jefferson et al. (2015), Perrin et al. (2009a), and Goldbogen et al. (2015). Sperm whales are found year round in California waters, but their abundance peaks in summer (Douglas et al., 2014). Their typical distribution includes waters over the continental shelf break, over the continental slope, and into waters greater than 2,000 m deep (Carretta et al., 2017c; Rice, 1989; Whitehead, 2003; Whitehead et al., 2008). Humpback whale occurrence in the Study Area peaks from December through June (Calambokidis et al., 2015). Their population trend seems to be increasing based on 2008 - 2012 aerial survey data in the area (Smultea and Jefferson (2014). The majority of blue whales sightings off southern California were in summer (62 sightings) and fall (9 sightings), with only single sightings in winter and spring (Campbell et al., 2015). Densities of blue whales were higher along the 200-m isobath (Redfern et al., 2013). Fin whales have frequently been recorded in waters of the Study Area and are present year-round (Barlow & Forney, 2007; Campbell et al., 2015). The HSTT EIS/OEIS (2018) provides a detailed summary of best available information on endangered marine mammal presence in the waters off Southern California.

Pinnipeds are especially concentrated around coastal breeding and resting sites, but they disperse widely offshore during foraging. The range of the threatened Guadalupe fur seal is centered on Isla Guadalupe, its primary breeding location, but it is likely to occur, feeding primarily on pelagic fish and squid, throughout the Study Area (Aurioles-Gamboa 2015).

**Consequences of the Proposed Action**

Floats were carefully designed to eliminate or minimize their potential threats to the environment. Phase 1a floats do not present reasonable threats to threatened or endangered species from physical strike, ingestion, entanglement, artificial lighting, acoustic, water quality, or chemical risks. Phase 1a floats are analyzed for potential impacts by disturbance. Additionally, although Phase 1a floats do not present reasonable threats from ingestion and entanglement, these are analyzed to substantiate the Navy's rationale that floats are not likely to adversely affect ESA-listed species.

Threatened or endangered marine invertebrate species may interact with the floats only if they scuttle on the shallowest portions of Tanner and Cortez banks (depths of 20-60 m), and this scenario is exceptionally unlikely because of the extremely low density of floats and the small size of Tanner and Cortez banks relative to the Study Area. Consequences of physical contact could elicit a temporary behavioral response, and no other effects are plausible. ESA-listed white abalone may interact with the floats, but this scenario is exceptionally unlikely and any impacts would be too small for any meaningful consequence to ESA-listed marine invertebrate species.

Threatened or endangered fish species would have only momentary interactions with deployment, passively drifting floats, and scuttled floats. The possibility that any threatened or endangered individual would ever encounter a float is discountable because of the extremely low density of floats. Disturbance associated with drifting floats may elicit a temporary behavioral response, such as avoidance or attraction to the floating object, and no other effects are plausible. Consequences of attraction could include increased susceptibility to predation and increased feeding efficiency for predators. Demersal threatened or endangered fish species (i.e., Gulf grouper) would likely not interact with floats because the majority of floats would be scuttled in water that is far deeper than their range. Fish entanglement in a weighted suspended line is not a real possibility as these structures would be highly visible, slowly drifting with the current, and without loose ends or loops that could entangle a fish. Ingestion by fishes is considered similarly implausible because the floats do not resemble food (i.e. fish or invertebrates) in size or texture. ESA-listed fish may interact with the floats, but any impacts would be too small for any meaningful consequence to ESA-listed fish species.

Threatened or endangered turtle species would have only momentary interactions with deployment, passively drifting floats, and scuttled floats. The possibility that any threatened or endangered individual would ever encounter a float is discountable because of the extremely low density of floats. Disturbance associated with drifting floats may elicit a temporary behavioral response, such as avoidance or attraction to the floating object, and no other effects are plausible. Potential ingestion-related consequences are discountable because the floats are too large and rigid for pelagic-feeding turtles to bite, and bottom-feeding turtles are adept at rejecting or processing non-food items without injury. Although non-food items are sometimes recorded in turtles' stomach contents, the floats' materials and construction are not similar to items found in pelagic-feeding turtles stomach contents. The possibility of sea turtle entanglement in a weighted suspended line would appear to be remote because no aspect of the floats are designed to entangle, entrap, or hook marine organisms, and because the weight at the end of the line would keep it from forming loops. ESA-listed turtles may interact with the floats, but the analysis indicates negative effects are discountable, and the conclusion is that the Proposed Action may affect but is unlikely to adversely affect to ESA-listed sea turtles.

Threatened or endangered marine mammal species would have only momentary interactions with deployment, passively drifting floats, and scuttled floats. During float deployment, the visual presence and noise associated with the M/V Diane G (or similar vessel) may elicit avoidance behavior. Consequences would be negligible because the animal could resume activity after moving either a short distance away or within the same area a short time later after the vessel moves on. The potential for the deployment vessel to strike a marine mammal would be avoided by following Navy Standard Operating Procedures. The possibility that any threatened or endangered individual would ever encounter a float is remote because of the extremely low density of floats. The potential for bottom-feeding marine mammals to encounter scuttled floats on the seafloor would be even lower because the majority of floats would be scuttled in water that is far deeper than the foraging area for bottom-feeding marine mammals (e.g., gray whale and humpback whale) (Hain et al. 1995; Ware et al. 2014). The potential for ingestion impact to marine mammals is discountable because the floats are orders of magnitude larger than baleen whales' typical prey, are several times larger than the largest debris items known to be ingested by whales, because the floats are rigid and there are zero records of large rigid ingested debris, and because bottom-feeding organisms are adept at rejecting or processing non-food items without injury (Laist 1997; Bergmann et al. 2015; Williams et al. 2011). Based on feeding behavior studies and the relative dearth of documented large debris ingestion, marine mammals clearly have the capacity to avoid a float prior to ingestion (Andrady 2011; Whitehead 2003; Williams et al. 2011). It is extremely unlikely that a marine mammal would become entangled in a line suspended from the Program's floats for three reasons. First is the low likelihood for marine mammals to encounter a float (suspended line with weight is only on a sub-set of floats). Second, the lines between floats and the weights present relatively low entanglement risk because they are vertically-oriented, very short, and low breaking strength (i.e., Knowlton et al., 2016). Third, there are no reports of a marine mammal becoming entangled in scientific instrumentation despite large quantities in use (e.g., one portion of a single NOAA program deployed 20 km of XBT wire since 2016 [expendable bathythermograph]). Guadalupe fur seals' chance of exposure to floats is somewhat greater than the other threatened or endangered marine mammals because seal concentrations at Guadalupe Island are adjacent to a Study Area boundary that is forecast to receive a greater number of scuttled floats. But direct interaction remains exceptionally unlikely because habitats within 12 nautical miles of the shore are specifically excluded from the study area and measures would be implemented to minimize potential for any floats to travel beyond the study area boundary. The sole reasonable potential interaction with any ESA-listed marine mammal is the low-likelihood possibility of temporarily interrupting feeding while encountering a float and avoiding or rejecting it. ESA-listed marine mammals may interact with the floats, but the analysis indicates negative effects are discountable, and the conclusion is that the Proposed Action may affect but is unlikely to adversely affect to ESA-listed marine mammals.

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# Appendix B
# Record of Non-Applicability and Air Quality Calculations

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# RECORD OF NON-APPLICABILITY (RONA) FOR CLEAN AIR ACT CONFORMITY

## ENVIRONMENTAL ASSESSMENT FOR THE OCEAN OF THINGS PROGRAM AT SAN DIEGO, CA

## SOUTH CENTRAL COAST AIR BASIN, SOUTH COAST AIR BASIN, AND SAN DIEGO AIR BASIN

## INTRODUCTION

The U.S. Environmental Protection Agency (USEPA) published *Determining Conformity of General Federal Actions to State or Federal Implementation Plans; Final Rule* in the 30 November 1993, Federal Register (40 Code of Federal Regulations [CFR] Parts 6, 51, and 93). The U.S. Department of the Navy (Navy) published *Clean Air Act (CAA) General Conformity Guidance* in OPNAVINST 5090.1D dated 30 October 2007 and the Navy guidance for compliance with the CAA General Conformity Rule, dated 30 July 2013. These publications provide implementing guidance to document CAA Conformity Determination requirements.

Federal regulations state that no department, agency, or instrumentality of the Federal Government shall engage in, support in any way or provide financial assistance for, license to permit, or approve any activity that does not conform to an applicable implementation plan. It is the responsibility of the Federal agency to determine whether a Federal action conforms to the applicable implementation plan, before the action is taken (40 CFR Part 1, Section 51.850[a]).

The General Conformity rule applies to federal actions proposed within areas which are designated as either nonattainment or maintenance areas for a National Ambient Air Quality Standard (NAAQS) for any of the criteria pollutants. Former nonattainment areas that have attained a NAAQS are designated as maintenance areas. Emissions of pollutants for which an area is in attainment are exempt from conformity analyses.

The project would occur within the waters offshore from the San Diego Air Basin (SDAB). San Diego County (which comprises the SDAB) is classified as a moderate nonattainment area for the 8-hour ozone ($O_3$) NAAQS.

The annual *de minimis* levels for SDAB are 100 tons of $NO_x$ and VOC (which are precursors to the formation of $O_3$), as listed in Table 1. Federal actions may be exempt from conformity determinations if they do not exceed designated *de minimis* levels (40 CFR Part 1, Section 51.853[b]).

**Table 1. Conformity *de minimis* Levels for Criteria Pollutants in the San Diego Air Basin**

| *Criteria Pollutant* | *de minimis Level (tons/year)* |
|---|---|
| Oxides of Nitrogen ($NO_x$) | 100 |
| Volatile Organic Compounds (VOC) | 100 |

## PROPOSED ACTION

Action Proponent: Space and Naval Warfare Systems Command, Naval Information Warfare Center

Location: San Diego, California

Proposed Action Name: Ocean of Things Program at San Diego, California

Proposed Action & Emissions Summary: The purpose of the Proposed Action is to develop a cost-effective, low-environmental impact program to characterize an oceanographic region by collecting and analyzing environmental and activity data at a scale and resolution that is currently not available. The Proposed Action is needed to fill a gap in maritime situational awareness by providing a regional, multivariate, high-resolution, real-time picture from a distributed sensor network on the ocean.

The Proposed Action would result in the deployment of a limited number of floats (up to 1,000) in a bounded area of the Pacific Ocean offshore of southern California and Baja California, overlapping the Navy's Southern California Range Complex, adjacent waters of the U.S. and Mexico Exclusive Economic Zones, and high seas of the global commons. Floats would be allowed to drift for one month, or until they approach a geofence where they would scuttle seaward of 12 NM of any shoreline, at the boundaries of the Study Area, or at the mock islands. Alternative 2 would be the same as Alternative 1 except the Study Area would be located farther off the continental shelf. Each float would contain a suite of commercially available sensors to collect environmental data—such as ocean temperature, sea state, salinity, and location—which will enable analysis of conditions and activities in the area.

The emissions from the deployment of floats under the Proposed Action would result from the vessel used to transport the floats from land to the in-water deployment areas. Offshore emissions were modeled using emissions factors published by the USEPA (2009), assuming a vessel operating for up to three roundtrips for a maximum of 6 days at 2 hours per day, including travel from Naval Base Point Loma in San Diego County after the floats have been loaded on to the vessel, travel in U.S. territorial waters to deploy the floats, and the return trip after the floats are deployed under each action alternative.

Estimated emissions due to implementation of the Proposed Action are shown in Table 2. The emissions generated offshore are conservatively applied to the SDAB, assuming that 100 percent of the emissions generated offshore would travel into the air basin. Based on the air quality analysis for the Proposed Action, estimated emissions would be below conformity *de minimis* levels.

**Table 2. Estimated Emissions in the SDAB Resulting from Implementation of the Proposed Action**

| ***Emission Source*** | ***Emissions (tpy)*** | | | | | | |
|---|---|---|---|---|---|---|---|
| | ***VOCs*** | ***$NO_x$*** | ***CO*** | ***$SO_2$*** | ***$PM_{10}$*** | ***$PM_{2.5}$*** | ***Pb*** |
| **Proposed Project Emissions - 2019** | | | | | | | |
| Vessel Emissions | 0.003 | 0.060 | 0.006 | 0.018 | 0.003 | 0.003 | N/A |
| **Significance Thresholds** | **100** | **100** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** |
| **Exceeds Air Quality Significance Threshold Standards?** | **No** | **No** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** |

*Note*: N/A = not applicable because the SDAB is currently in attainment of the NAAQS for these criteria pollutants. Pb emissions factors were not available for the vessel used in the Proposed Action.

Affected Air Basins: South Central Coast Air Basin, South Coast Air Basin, and San Diego Air Basin

Date RONA Prepared: 30 January 2020

## PROPOSED ACTION EXEMPTION(S)

The Proposed Action is located within a nonattainment area; therefore, the Proposed Action is subject to the General Conformity Rule requirements. Because project emissions would be below *de minimis* thresholds, the project has demonstrated conformity with the requirements of the General Conformity Rule, and a formal CAA Conformity Determination is not required.

## ATTAINMENT AREA STATUS AND EMISSIONS EVALUATION CONCLUSION

San Diego County comprises the SDAB, and is a moderate nonattainment area for the 8-hour federal $O_3$ standard (VOCs and $NO_x$ are precursors to the formation of $O_3$).

Emissions associated with the Proposed Action were calculated using data presented in Chapter 2 of the Environmental Assessment/Overseas Environmental Assessment, project design details, general air quality assumptions, and modeled using emissions factors from the ICF International report to the USEPA (2009).

The Navy concludes that *de minimis* thresholds for applicable criteria pollutants would not be exceeded as a result of implementation the Proposed Action. The emissions data supporting that conclusion, which is a summary of the calculations, methodology, and data can be found in the calculations attached below. Therefore, the Navy concludes that formal CAA Conformity Determination procedures are not required, resulting in this RONA.

## RONA APPROVAL

To the best of my knowledge, the information presented in this RONA is correct and accurate, and I concur in the finding that implementation of the Proposed Action does not require a formal CAA Conformity Determination.

Date: ______________________ Signature: ____________________________________

**Annual Peak Estimated Emissions from the Proposed Project within the San Diego County Air Pollution Control District**

| Emission Source | Emissions (tpy) | | | | | | | Emissions (tpy) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | VOCs | $NO_x$ | CO | $SO_2$ | $PM_{10}$ | $PM_{2.5}$ | Pb | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| **Proposed Project Emissions within the San Diego County APCD - 2019** | | | | | | | | | | | |
| Vessel Emissions (tons/year) | 0.002 | 0.059 | 0.005 | 0.018 | 0.002 | 0.002 | N/A | 2.892 | 0.000 | 0.000 | 2.935 |
| **Significance Thresholds (tons/year)** | **100** | **100** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** |
| **Exceeds Air Quality Significance Threshold Standards?** | **No** | **No** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** |

Legend: CO = carbon monoxide; $NO_x$ = nitrogen oxides; Pb = lead; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter; $PM_{10}$ = particulate matter less than 10 microns in diameter but greater than 2.5 microns in diameter; $SO_2$ = sulfur dioxide; VOCs = volatile organic compounds.
CO2e = CO2 + (CH4 * 21) + (N2O * 310)

Notes: The San Diego Air Basin is a moderate nonattainment area for the 8-hour $O_3$ NAAQS (VOCs and $NO_x$ are precursors to the formation of $O_3$). Pb emissions factors were not available for the vessel used in the Proposed Action.
NA = Not applicable because the SDAB is currently in attainment of the NAAQS for these criteria pollutants; tpy = tons per year.

**Estimated Emissions within 12 nm of the California Coast as a Result of Implementation of Alternatives 1 or 2**

| Source | # of Days | Hrs/Day | Emission Factors VOC | NOx | CO | SOx | $PM_{10}$ | $PM_{2.5}$ | $CO_2$ | $CH_4$ | $N_2O$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Component | | | | | | | | | | | |
| Offshore deployment of floats - Phase 1a (2019) | | | | | | | | | | | |
| **M/V Independence (Tier 3 Engine, 61' Vessel)[1]** | **6** | **2** | **0.373** | **9.8472** | **0.8206** | **2.96162** | **0.35062** | **0.32078** | **481.97568** | **0.002984** | **0.023126** |

| % of operations within 12-nm of shore | Total Project Emissions (pounds) VOC | NOx | CO | SOx | $PM_{10}$ | $PM_{2.5}$ | $CO_2$ | $CH_4$ | $N_2O$ | |
|---|---|---|---|---|---|---|---|---|---|---|
| **100%** | **4.476** | **118.166** | **9.847** | **35.539** | **4.207** | **3.849** | **5,783.708** | **0.036** | **0.278** | |
| | 4.476 | 118.166 | 9.847 | 35.539 | 4.207 | 3.849 | 5,783.708 | 0.036 | 0.278 | Total (pounds) |
| | **0.002** | **0.059** | **0.005** | **0.018** | **0.002** | **0.002** | **2.892** | **0.000** | **0.000** | **Total (tons)** |

Notes: Emission factors are from ICF International report to the USEPA "Current Methodologies in Preparing Mobile Source Port-Related Emissions Inventories", April 2009 (converted from g/kW-hr to g/hp-hr by multiplying by 0.746 kW/hp).

Assumptions: # of days & hours/day of operation developed from Proposed Action, based on operations occuring within 12 nm from shore.

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